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Chemical Week

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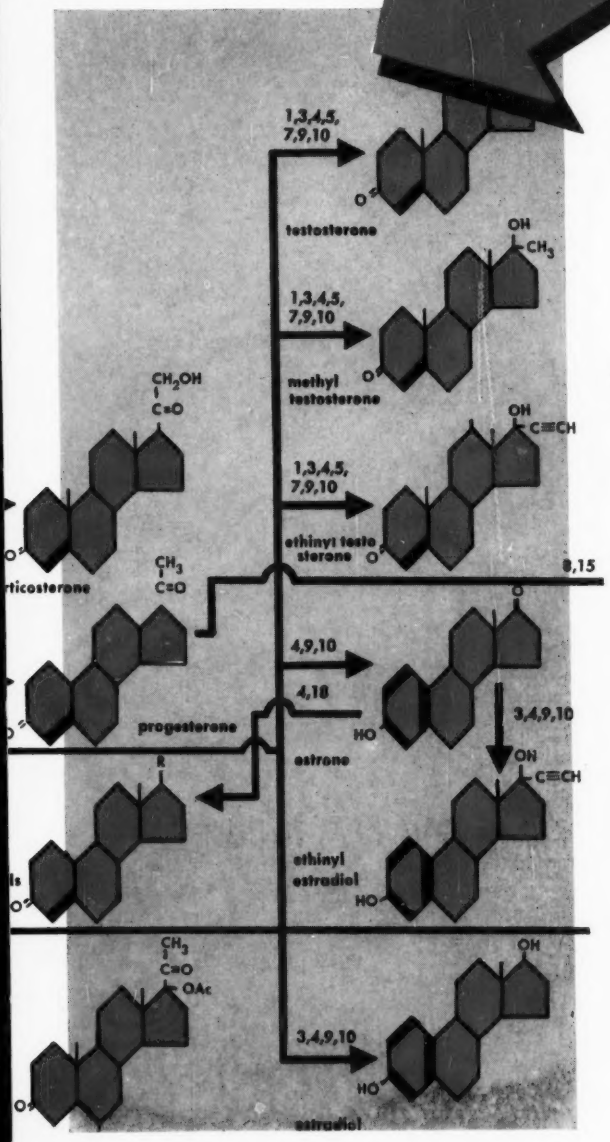

Record year for rubber in '59. Bright prospects pinned to new products, processes . . p. 21

CW Report: Steroids—a $120-million treasure trove for drug industry . . . p. 37

Are big gas turbines reliable in process roles? Makers state their case . . . . p. 54

Catalysts join smog fight. Auto makers push research for engine exhaust unit . . p. 74

Split in ammonia price roils marketers; Eastern increases counter Western cuts . p. 82

January 31, 1959

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Average available Chlorine, %	57.0	59.7	69.9	88.5
Melting point ° C	230*	230-250*	225	225-230
pH (saturated solution)	7.3	6.1	2.6	2.9
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*decomposes without melting

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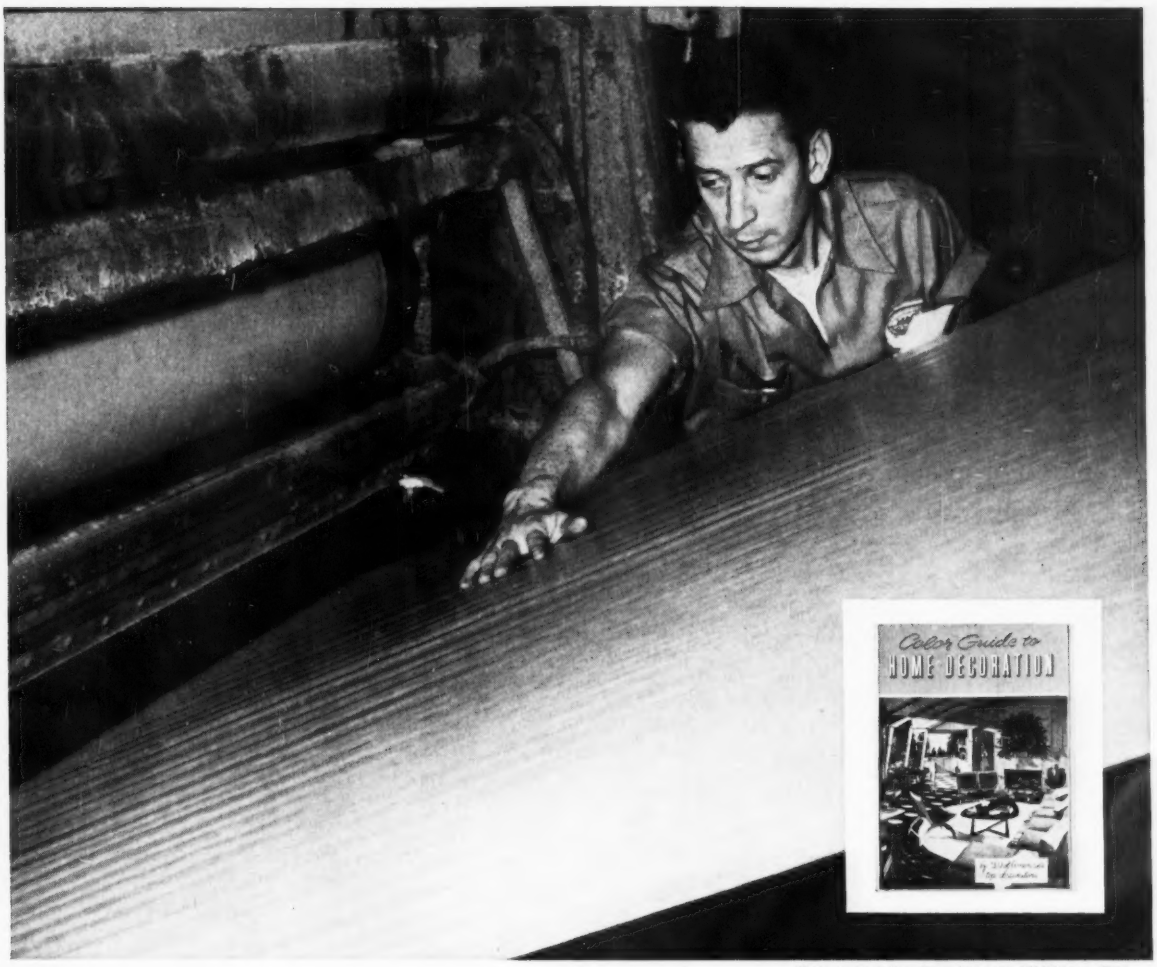

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42,340 copies of this issue printed

Vol. 84
No. 5

Chemical Week is published weekly by McGraw-Hill Publishing Co., Inc., 330 W. 42nd St., New York, 36, N. Y. Place of publication: 3rd and Hunting Park Ave., Philadelphia 40, Pa. Second-class postage paid at Philadelphia. Subscription: $3/year in U.S.A. Send subscription correspondence and change of address to Fulfillment Manager, Chemical Week. Please see page 8 for subscription requirements.

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news briefs...

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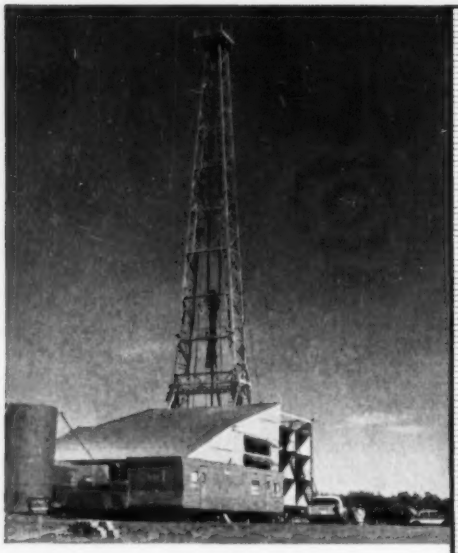

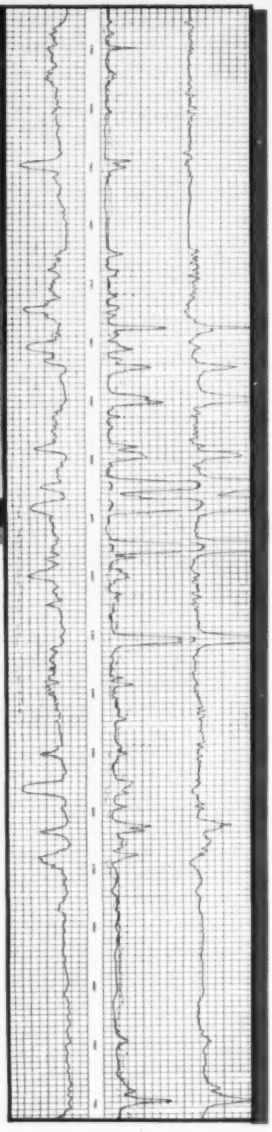

***Salt or Anhydrite Your Drilling Problem?** M & C's Attapulgus drilling clay gives highest yield of any clay in either saturated gyp or brine muds

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Illustration shows ammonium nitrate prills, 10X magnification, coated evenly with an M & C Attapulgite conditioner that provides a highly-sorptive moisture barrier. M & C anti-caking agents include several Attapulgite products and also various surface modified aluminum silicate pigments (ASP's). Investigate the M & C line whenever chemicals must be conditioned against packing effects caused by time of storage, pressure, temperature, humidity and the like. M & C anti-caking agents are neutral-colored, uniform, ultra-fine, inert powders. A little bit goes a long way—usually less than 2% by weight is needed—and they are low in cost, too.

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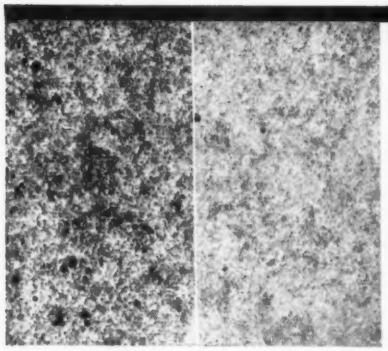
***Reinforced Plastic** underbody of sports car exhibits high impact and flexural strengths with ASP filler

Molded Fiber Glass Body Company, Ashtabula, Ohio specializes in molding large, complex reinforced plastic parts. Photo shows preparation of the preform for a car underbody—a part subject to rugged road shock. Use of ASP fillers gives top reverse impact and 180° flexural modulus values. Molded Fiber Glass Body also reports easier mold release, longer pot life, ideal thixotropy. This is a *starred* item. Use the coupon.



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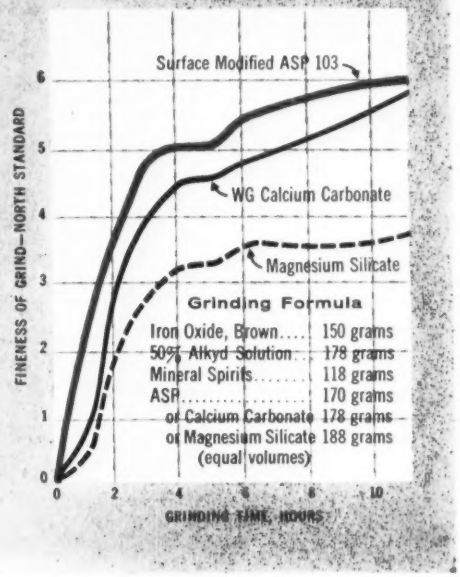
Asphalt Laminated Kraft Paper benefits through penetration control with ASP Additive

Photograph shows marked decrease in molten asphalt penetration in 30-30-30 kraft sheets when M & C's ASP 400 was added to the asphalt system. Without addition of ASP, asphalt can strike completely through the paper—which is undesirable. Laboratory studies indicate that penetration control with ASP's helps solve problems connected with bleeding of the asphalt. Could these additives benefit your formulation? Use the coupon for complete test details.

Paint Chemists: new Surface Modified ASP extender pigments reduce grinding time, lower costs

Graph illustrates superiority of M & C's new Surface Modified ASP 103 in gaining desired fineness of grind in quickest time (test details on request). In organic protective systems the new Surface Modified ASP's not only cut grinding time, but also provide superior suspension properties, improved water resistance and adhesion of the film to metallic surfaces. Bulletin T. I. 1026 presents all the data. Use the coupon for your copy and for test samples.



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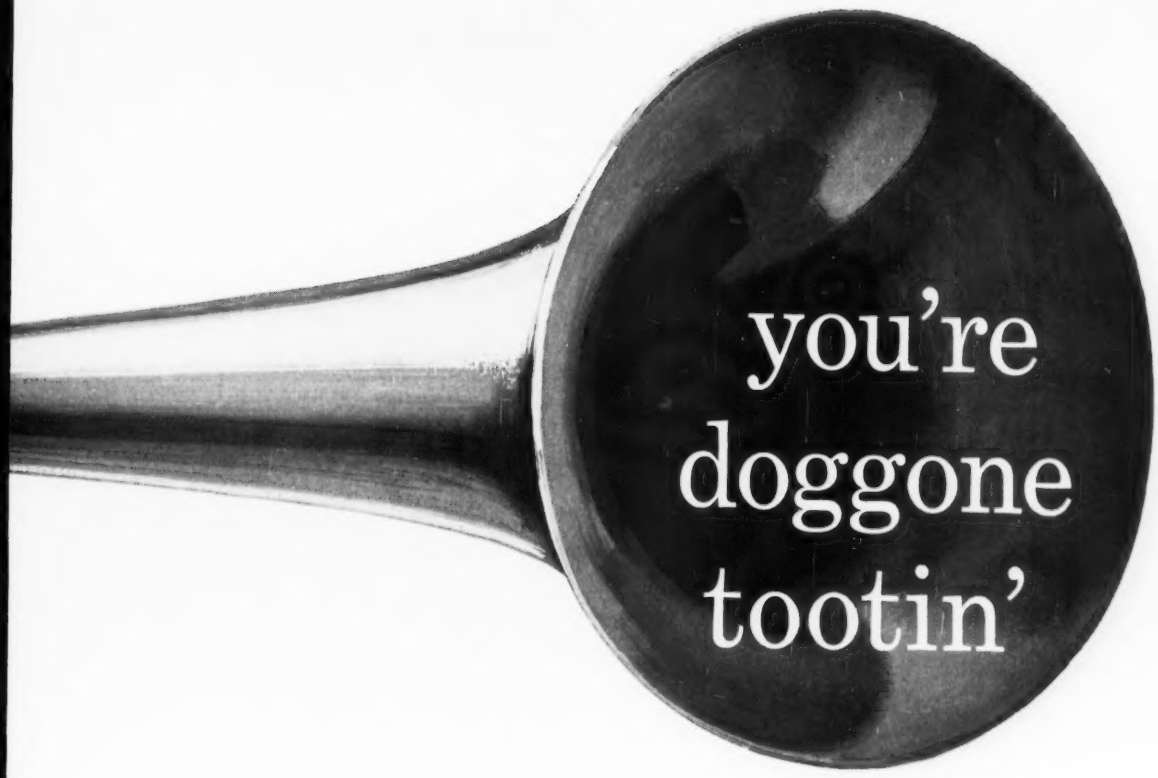

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VIEWPOINT

GOVERNMENT RESEARCH is booming:

- President Eisenhower has revealed that Atomic Energy Commission contractors have developed an efficient, practical atomic battery.
- The Bureau of Mines has revealed a breakthrough in electric-arc casting of molybdenum.
- Health, Education & Welfare Secretary Flemming revealed the development of a new pain-killer.

Entirely by coincidence, no doubt, these breakthroughs occurred in the six days preceding the day the new federal budget went to Congress.

We're not opposed to the free enterprise shown in such timing.

But there are some disturbing implications — particularly where health matters are involved. On this point, we find ourselves in agreement with the views of Ed Beckwith, president of Crookes-Barnes Laboratories:

The announcement of this new government drug was premature. The drug is not in production. It is not available to patients. No telling how many patients who need such a drug have had their hopes raised. No one knows yet whether this drug will prove too toxic, whether it will run into the host of problems we have come to anticipate with all new drugs. If an individual pharmaceutical company had made such an announcement, it would have been berated.

The public can now see what many of us have anticipated for some time—that the federal government has become the strongest competitor in our industry. The $300-million/year federal medical research program is not aimed solely at basic problems and the widening of fundamental knowledge; it is aimed also at product research.

Most companies find it wise to invest in basic research. But in our competitive economy, no company can afford to spend very much on projects that have no direct connection with its product line. How much more profitable would it be, then, for the government to channel its funds into basic studies, rather than into product research—a field in which private firms are so adept.

H C E Johnson

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JANUARY 31, 1959 **Vol. 84, No. 5**

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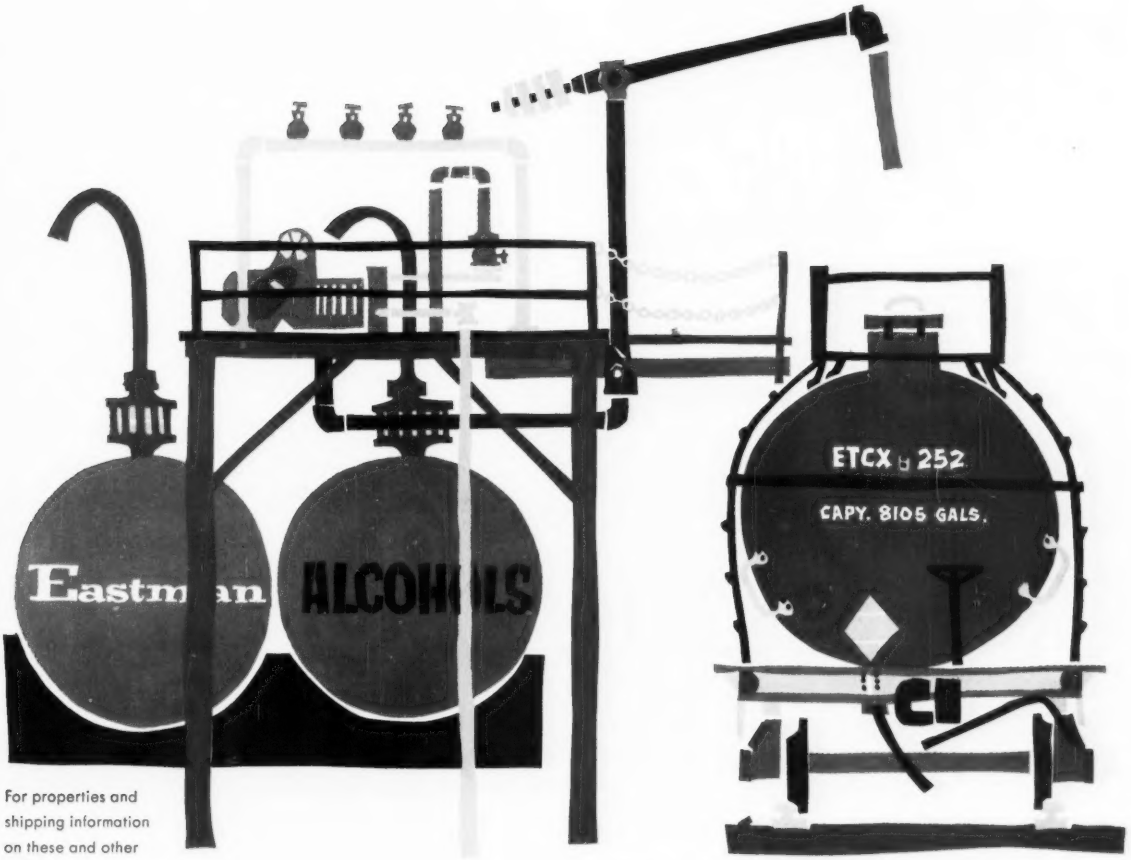

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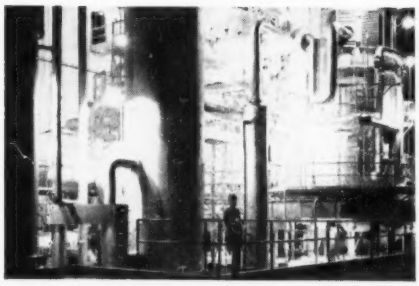

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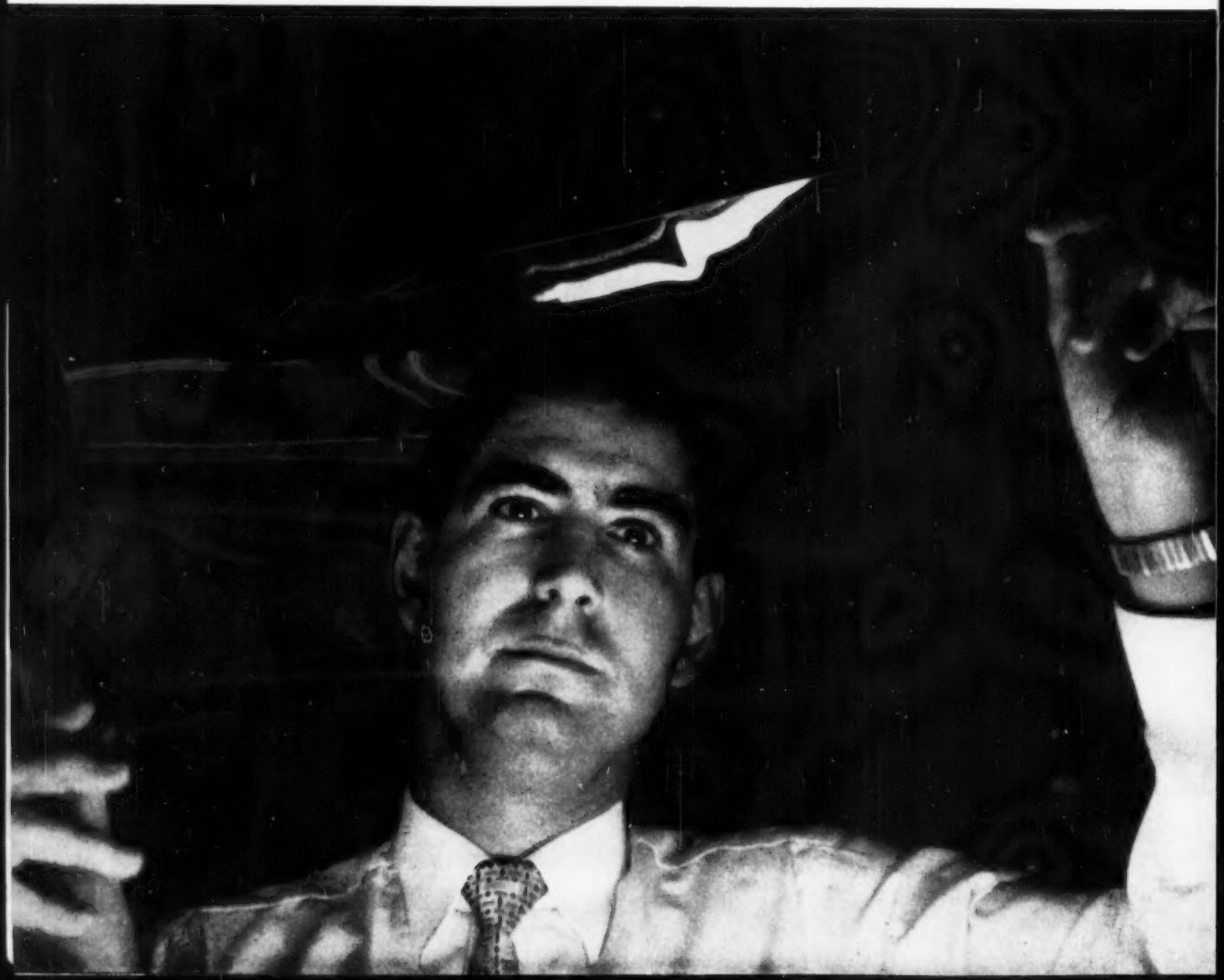

OPINION

Go-Ahead on Nickel

TO THE EDITOR: Just for the record, re the article on the Cuban revolt (*CW, Jan. 10, p. 21*), there is no thought of discontinuing the nickel-cobalt project at Moa Bay. We are on schedule and expect to be in production this summer as planned.

E. C. K. READ
Freeport Sulphur Co.
New York

CW *did not intend to imply that Freeport had decided to discontinue its Moa Bay operations.*—ED.

Make It 'Elastex'

TO THE EDITOR: In announcing our two new polymeric plasticizers (*CW, Nov. 29, '58, p. 64*), they were described as being designated "Elastic 36-R" and "Elastic 37-R." The correct designations are: "Elastex 36-R and Elastex 37-R." . . .

JAY W. LEVY
Plaskon News Service
Plastics and Coal Chemicals Division
Allied Chemical Corp.
New York

Borohydrides for Oxos

TO THE EDITOR: Your article (*CW, Dec. 27, '58, p. 64*) on our new borohydride products and their use for oxo-alcohol stabilization was excellent. The facts were accurate and the writing interesting. We were very pleased with the entire article. . . .

ROBERT C. WADE
Manager, Technical Marketing
Metal Hydrides, Inc.
Beverly, Mass.

Brucine vs. Quassin

TO THE EDITOR: While the article "Seeking an Out from Brucine" (*CW, Jan. 3, p. 38*) is very interesting, I do feel that there are a few points in this article that need clarification.

One might derive the impression that in making SDA-40 denatured alcohol, the producer may use 1.5 oz. each of brucine and quassin per 100 gal. instead of 3 oz. of brucine. This is not the case, and under Alcohol and Tobacco Tax Division rule, 1.5 oz. of quassin alone [*or 1.5 oz. of brucine alone*—ED.] may be used to denature 100 gal. of alcohol to make SDA 40.

S. B. Penick & Co. is mentioned as a major U.S. producer of quassin, and this is indeed true. Immediately after this, it is implied that we are sending some of our quassin production into Canada at a price of $2.50/oz., and this is not a fact. We have been producing quassin for denaturing alcohol for many years, supplying this production into Canada for this purpose, and our price is $1.80/oz. when sold into Canada as well as in the U.S.

PETER W. RIEBLING
Manager
Botanical Extracts and Alkaloids
S. B. Penick & Co.
New York

The traditional Canadian quassin price has been $2.50; but with the increasing imports of Penick's material (at $1.80 plus 15% duty plus shipping charges), the average price in Canada is now probably closer to $2.25.—ED.

MEETINGS

American Society for Testing Materials, committee week meeting, Penn-Sheraton Hotel, Pittsburgh, Feb. 2-6.

National Assn. of Purchasing Agents, Chemical Buyers Group, midwinter conference, Commodore Hotel, New York, Feb. 3.

American Coke and Coal Chemicals Institute, Western regional meeting, Drake Hotel, Chicago, Feb. 5.

Parenteral Drug Assn., dinner meeting, Statler Hotel, New York, Feb. 5.

American Institute of Mining, Metallurgical and Petroleum Engineers, annual meeting, San Francisco, Feb. 15-19.

Chemical Market Research Assn., meeting; theme: chemicals for the textile industry; Dinkler Plaza Hotel, Atlanta, Feb. 18-19.

National Chemical Credit Assn., sixth annual meeting, Sheraton Hotel, Philadelphia, Feb. 19.

Technical Assn. of the Pulp and Paper Industry, 44th annual meeting, Commodore Hotel, New York, Feb. 23-26.

American Institute of Chemical Engineers and **American Chemical Society,** sixth annual joint technical meeting, King Edward Hotel, Beaumont, Tex., March 13.

National Assn. of Corrosion Engineers, 1959 Corrosion Show and 15th annual conference, Chicago, March 16-20.

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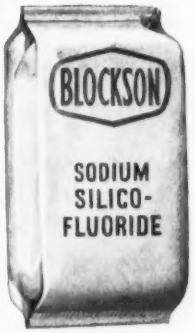

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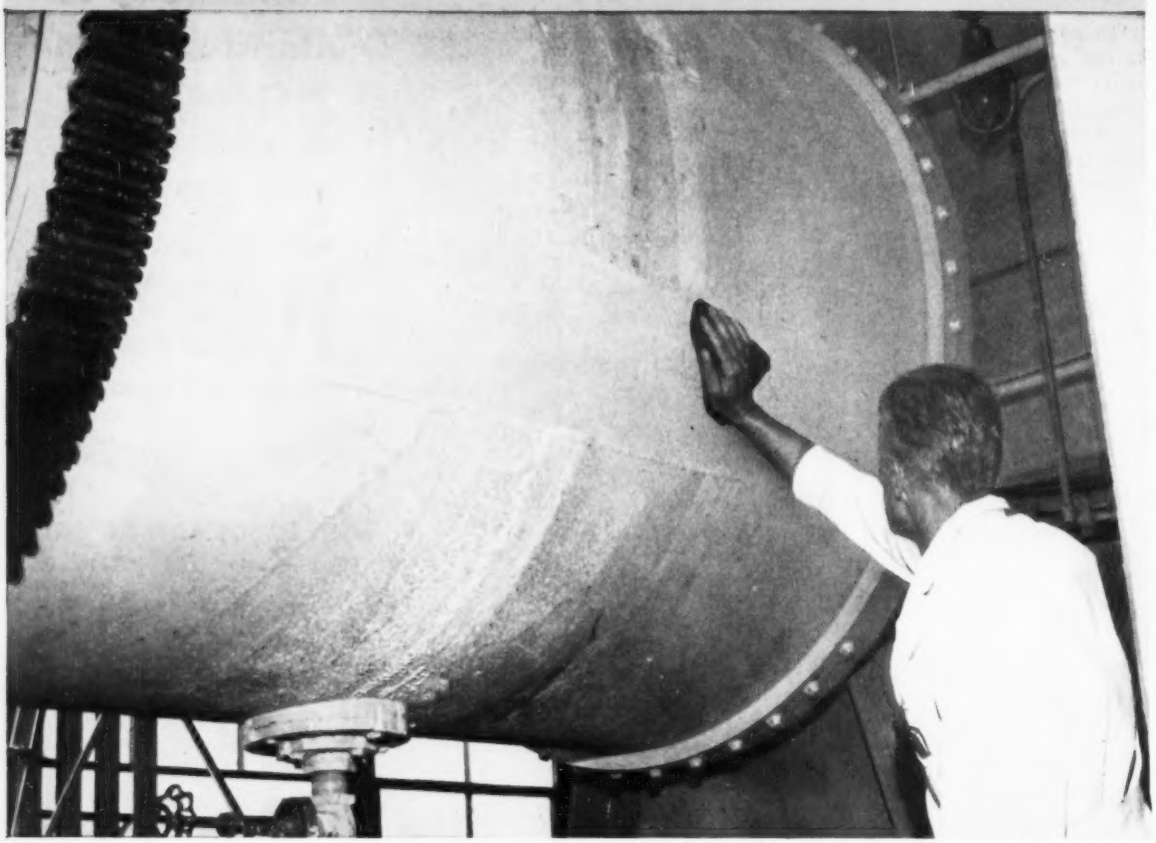
BLOCKSON CHEMICAL COMPANY
Division of Olin Mathieson Chemical Corporation
Joliet, Illinois

At The Glidden Company...



At The Glidden Company, paint drippings from a pebble and steel ball mill are easily cleaned off the Epon resin-based exterior surface coating with a solvent-dipped rag.

Chemical-resistant Epon® resin-based coatings guard paint production equipment from corrosion ...greatly reduce maintenance costs

At one of the paint production plants of The Glidden Company, enamel coatings on equipment were often stripped down to bare metal in only 30 days by the corrosive action of caustic cleaners. Maintenance costs were high.

To reduce costs for general housekeeping and repainting, the grinding mills, storage tanks, structural steel, and concrete areas were coated with Glidden's own Epon resin-based paint, Nu-Pon Cote.

Even though the Epon resin-based coatings are constantly exposed to hot caustic soda solutions, solvents, paint splashes, and abrasion, a fast washing down with solutions of petroleum and ester solvents keeps them clean and bright. Equipment is completely free from corrosion. *The Epon resin-based coatings have already lasted 4 times longer than the previous enamels.*

Most paint users are already aware of the many advantages offered by Epon resin formulations . . . excellent adhesion, resistance to abrasion, impact, heat, and humidity extremes.

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SHELL

Business
Newsletter

CHEMICAL WEEK
January 31, 1959

Evidence of snowballing optimism comes this week from spokesmen for various CPI commodity groups.

Consensus of chlorine producers, as expressed by Robert Mitchell Jr., newly elected secretary-treasurer of the Chlorine Institute, is that '59 will be a "substantially better" year for chlorine than '58. About 765 tons/day of capacity will be added during the year, bringing potential daily output to more than 13,000 tons.

And National Distillers Chairman John Bierwirth sees a resurging demand for titanium. Bierwirth said Mallory-Sharon, a partly owned subsidiary, is budgeting a titanium sales boost to $18 million this year vs. $13 million in '58. He said the forecast is based on steadily increasing orders since the fourth quarter of '58 plus increasing interest on the part of aircraft companies.

Shipments of the metal in December were reportedly 20% ahead of last year's average monthly rate.

•

Drugs continue to hurtle ahead.

Pfizer President John McKeen, for example, predicts sales of antibiotics will climb 15% between '58 and '62. And, according to Wyeth research chief Charles Kern, demand for new tranquilizers will "keep markets expanding." Other drug executives have also cited vitamins, vaccines, hypotensives as rapidly growing fields.

In paper, William Hanway, International Paper Co. secretary, told Philadelphia security analysts that a flurry of activity in the final months of '58 brought volumes up to '57 levels. The outlook for '59, he said, is one of "tempered optimism."

Hanway reported that newsprint is also picking up after a sharp decline in '57 and '58 because of dips in advertising linage and strikes.

•

Use of companies' cost data is currently the hottest issue in the Federal Trade Commission's antibiotics case (*CW, Jan. 17, p. 21*).

Last week, FTC trial attorneys—who previously had submitted numerous Patent Office documents relating to tetracycline and other antibiotics—offered as evidence a mass of exhibits drawn from the accused companies' files. These papers purportedly show: (1) list of prices at which tetracycline was offered in 1955-57; (2) actual invoices for tetracycline shipments each January in those years in eight large and medium-size cities; and (3) breakdown of tetracycline sales by dosage form and by class of customer.

At the insistence of four of the companies concerned, Hearing Examiner Robert Piper overruled FTC lawyers and ordered that these

papers not be part of the public record. American Cyanamid, Bristol, Pfizer and Olin Mathieson have fought against disclosure of their figures on the ground that they are trade secrets. Upjohn has supplied its figures ungrudgingly, arguing that they show such a modest profit on tetracycline as to disprove any "conspiracy" charge.

More company records will be due during the second round of hearings, March 9-27. Piper has ordered the four protesting companies to furnish figures on costs of production and distribution of their tetracycline products. Upjohn has already provided such data. Also on tap in the March hearings: first oral testimony in the case.

•

Chemical industry reaction to the Mikoyan mission: "No sale."

While government agencies are re-evaluating policies on U.S. trade with the Soviet Union, the Manufacturing Chemists' Assn. has reviewed its own position and has decided to "reaffirm strong opposition to selling U.S. production know-how and plants to the Soviets." But MCA does not oppose U.S.-Soviet trade in commodities or finished products.

•

The boom in petrochemicals continues unabated. This week, Coastal Products Co.—new joint venture of Sunray Mid-Continent Oil and Suntide Refining—is completing plans for a 7,000-bbls./day delayed coking plant at Corpus Christi, Tex. The $3-million project will take feedstock from Suntide's adjacent 65,000-bbls./day refinery (also from other nearby refineries) and turn out propane, propylene, butane, butylene, gasoline, gas oil, and petroleum coke for production of graphite electrodes.

•

More late earnings add luster to '59 prospects (*see p. 23*).

The Glidden Co.'s president, Dwight Joyce, predicts an 8% sales boost in fiscal '59—from $185 million to $200 million. The company's goal, said Joyce, is a 20% pretax return on investment. Glidden has earmarked $40 million for capital expansion in the next five years.

McKesson & Robbins posted record sales of $172.5 million and profits of $3.5 million in the quarter ended Dec. 31. This compares with $167.7 million and $3.2 million in the comparable '57 quarter.

Smith, Kline & French reports '58 sales of $124.1 million and earnings of $20.9 million, up 7% and 2%, respectively, over '57.

Norwich Pharmacal Co. upped sales and earnings for the seventh straight year. Sales rose to $37.2 million, up 11%, while profits climbed 10%, to $4.3 million.

Nopco Chemical's year-end profits totaled $1.8 million, compared with $1.6 million in '57.

Less fortunate was Catalin Corp. with a sales dip from $23.8 million in '57 to $20.8 million last year. Profits skidded from $454,948 to $176,790 in the same period.

BRIEFS

on information about sodium chlorate for those interested in chlorine dioxide ... a new drum for sulfides ... a grease that won't burn or corrode ... a booklet on trichlorethylene

Why you should know more about sodium chlorate

You've undoubtedly been hearing a lot about chlorine dioxide—how it is an unusually effective oxidizing agent—how it imparts no taste or odor to end products.

Not nearly as much has been said about chlorine dioxide's starting point—sodium chlorate. We think this ought to be corrected, since most everyone generates the chlorine dioxide right at the use point.

So it is we offer you a bulletin and technical data sheet.

The bulletin tells you all the accepted precautions used in handling and storing sodium chlorate. It tells how to unload a tank car and explains the operation and design of the valves used. It lists physical and chemical properties and illustrates them in a series of graphs and charts. It also offers methods of analysis.

The technical data sheet tells why more people use more Oldbury® sodium chlorate than any other brand. A typical analysis shows this brand to be 99.8% pure. No water insolubles. No free metals.

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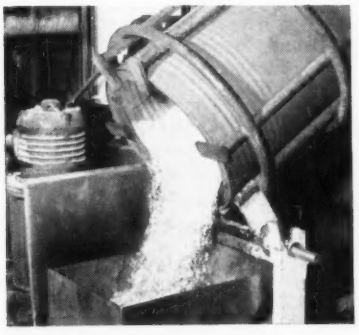
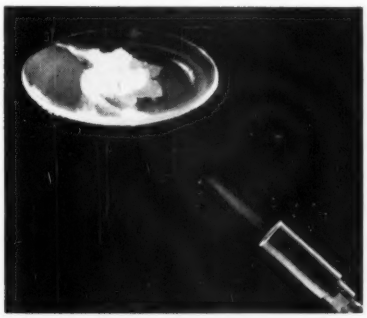
It has an 18-inch opening—four inches wider and 65% larger in area than its predecessor.

The new opening makes it much, much easier to empty either by pouring or with a scoop or shovel. It's safer to use, too. Flakes never pile up around the opening.

We use only brand-new drums; none are re-used. A lacquer lining prevents iron pick-up during shipping and storage. Six lugs hold the lid, keeping it air- and moisture-tight.

For specs on the sodium sulfide and sodium sulfhydrate that go into the drums, check the coupon.





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BEHIND THE NEWS

* * *

SunOlin to Build $10 Million Urea Manufacturing Plant

PHILADELPHIA — A urea manufacturing plant to be built by a newly-formed concern jointly owned by Sun Oil Co. and Olin Mathieson Chemical Corp. will cost between $10 million and $11 million, Sun disclosed here.

Sun and Olin Mathieson announced formation of the concern, called SunOlin Chemical Co. last July, and said then a plant would be constructed to make urea adjacent to Sun's Marcus Hook, Pa., refinery. A Sun spokesman said the site selected adjoins the Marcus Hook refinery but is just across the Pennsylvania border in Delaware.

The plant will have capacity to produce about 73,000 tons of urea a year, for use in making chemicals, fertilizer and cattle feed. Construction is scheduled to begin next spring.

Process by Montecatini-Kellogg!

First news release on SunOlin's new urea plant was the above announcement from the Wall Street Journal, December 23. Back of this story is that SunOlin Chemical Company will use a Montecatini-Kellogg Liquid Recycle Process, and that Kellogg will build this new 222-ton/day urea plant.

SunOlin's selection of the Montecatini-Kellogg route for its initial venture into a highly competitive market is significant recognition of the economics involved. Among the many advantages in this instance are: (1) Low initial investment; (2) Low operating costs and corrosion-free maintenance; (3) Complete conversion of the ammonia and carbon dioxide feeds; (4) High purity product, with biuret content less than one per cent; (5) Low-moisture, free-flowing prills without drying or coating operations.

Kellogg is privileged to participate in this new undertaking for SunOlin. If *you* are interested in urea, complete information on the Montecatini-Kellogg Processes may be obtained by writing Kellogg's Contract Sales Division for its recent brochure.

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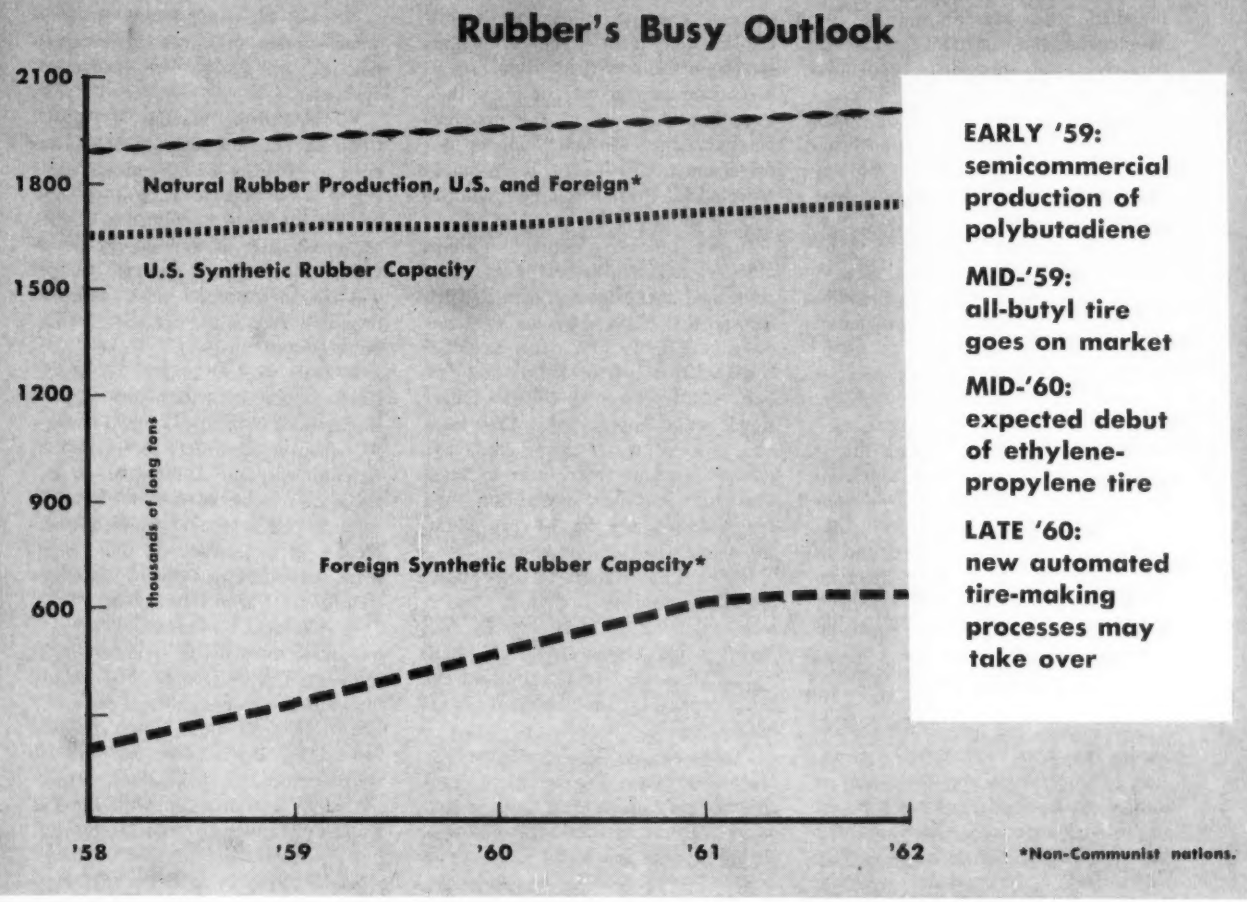
Chemical Week
January 31, 1959



Rubber's Growth Pace Quickens

At a shareholders' meeting in Akron, O., last week, Firestone Tire & Rubber Co. Chairman Harvey Firestone, Jr., painted a rosy picture of record sales in '59. His cheerful outlook is shared by top-management men throughout the rubber industry. Buoyed by a favorable auto outlook, plus a number of impending technological advances, most expect '59 to be the best sales year yet.

U.S. Rubber Chairman H. E. Humphreys, Jr., foresees rubber industry sales reaching a new peak of $6 billion — compared with $5.5 billion in '58. Humphreys revealed that U.S. Rubber will boost capital expenditures to $30 million this year, vs. $25 million in '58.

Similar statements have been flooding in from other rubber companies. Seiberling rubber, for instance, is offering 106,481 additional shares, will sell its stockholders one new share for every four they now hold. Aim: pay off bank loans and garner additional working capital for the expected buildup.

New Capacity on Tap: In all, U.S. companies will add 600,000 tons of new rubber capacity — practically all synthetic—between now and '62. This will boost combined rubber capacity to about 4.4 million long tons—almost 30% over '57 capacity of 3.4 million l.t.

And, overseas, synthetic rubber capacity will grow even faster. Karl Nygaard, B. F. Goodrich director of business research, estimates that foreign (non-Communist) output will almost triple in the period from '57 through '62 (*chart above*).

This threat to U.S. markets abroad —about 200,000 tons of rubber were exported in '58—may not be severe.

Contributing to the industry's high optimism are prospects for a spate of technological advances:

This week, Firestone is revealing plans for the world's first facility to make two new products: Coral, described as the man-made equivalent of natural rubber; and Diene, a rubber extender. Capacity of the Orange, Tex., plant: 30,000 tons/year.

By '60, at least one of the "Big Four" rubber companies hopes to install automated tire-making machines that will slash production costs; Enjay,

marketing subsidiary of Esso, will launch an all-butyl tire this summer; Phillips is starting production of polybutadiene this March; and by '60 Montecatini may introduce a less-expensive ethylene-propylene copolymer tire.

One of the new tire-making machines — and other automation projects — accounted for 60% of last year's budget for U.S. Rubber's chief research laboratory in Wayne, N.J. The new machine — believed to be in the final testing phase — is said to be capable of turning out 480 tires/hour. It could cut production work forces by as much as 60%. According to reports, it is all but operable right now, will probably be installed in factories next year.

This speculation — though highly informed — comes from unofficial sources. The company itself is noncommittal. G. R. Cuthbertson, U.S. Rubber vice-president and tire division manager, says: "No machine such as the one described has been developed to a point where it can be installed on a production line, nor can we say at this time when it is likely to be ready for such use."

It is known that other rubber companies are also researching automation. How far along they are is difficult to say, but many are believed to be well advanced. Goodyear, for instance, is reported to be perfecting a heavy-duty tire-making machine. Goodyear, among others, reports only that it is working on all types of automation but is not ready to put new machines on the production line.

Butyl Debut: As reported earlier (*CW, July 27, '57, p. 84*), the price of Esso's butyl tire may be slightly higher than comparable tires now on the market — although qualities such as smoothness of ride, increased wear-resistance and gripping power could offset the difference.

Other big rubber firms have been working on a butyl tire, but they are not as far along as Esso. One big reason for Esso's dominant interest, of course, is its big investment in the field. Its Enjay and Humble Oil subsidiaries have the lion's share of U.S. butyl rubber capacity.

Phillips Polybutadiene: Still another development causing a stir is Phillips Petroleum's plan to start semicommercial production of polybutadiene —a polymer that will seek part of the $2.6-billion/year tire market.

Phillips researchers earlier had tabbed polybutadiene as a "spectacular success" after preliminary testing for use in tires. Last week, a Phillips spokesman told *CW*: "Production at a semicommercial rate of more than 1 million lbs./year of the new cis-polybutadiene synthetic rubber — tradenamed Cis-4—will begin about March 15." Price for large quantities will be about $1/lb., he added.

In an official statement, Phillips officials say: "Further tests have confirmed the original results, which showed that Cis-4 alone, or in blends containing up to 50% natural rubber, consistently outperformed natural rubber. Cis-4 gave 30%-40% longer tread wear in passenger-tire tests, and, of even greater importance, gave remarkably long tread wear in truck tires with less heat generation than for natural-rubber tires of corresponding sizes."

'PEP' Tire Debut: A new polypropylene-ethylene-copolymer tire is also expected to turn up in '60. That's when Mario Ottolenghi, U.S. liaison man for Montecatini, expects the company to complete final phases of testing.

Cost is expected to be substantially lower than that of conventional synthetics; ethylene and propylene sell for 4-5¢/lb., compared with 12-15¢/lb. for styrene and butadiene.

The PEP copolymer has been actively investigated in this country for some time. U.S. rubber firms say they have been unable to obtain samples of Montecatini's product for evaluation.

And Indiana Standard has been studying copolymerization of ethylene and propylene for roughly 10 years, recently has intensified its work in this field.

One Indiana official reports that a "sizable" pilot plant is now under construction, should be onstream within "a couple of months." But Standard won't use the new unit exclusively for copolymers; it's part of the company's over-all polyolefins program.

Formula for Success: With the expected boost in exports, sharply improved domestic demand, and new products and applications emerging from the industry's $85-million research program, '59 will be a big year. And the industry is looking to even bigger gains in the '60s.

Missile Rivalry

Newest high-energy-fuel developments underscore growing competition in the fast-growing propellent business.

• This week, Stauffer - Aerojet Chemical Co. disclosed that it has been awarded a $2-million U.S. Air Force prime contract to build a large pilot plant near Sacramento, Calif., for production of high-energy boron fuels. The company stresses that it will use a new process that's "expected to greatly reduce the production cost" of the liquid fuels.

• Last week, Thiokol Chemical Corp. received from the Army's Rocket and Guided Missile Agency a $2.4-million contract for research, development and delivery of an unspecified number of improved XM33 solid-propellent rocket motors, complete with fuel. Work on this assignment will be carried out by Thiokol's Redstone Division (Huntsville, Ala.).

• Hercules Powder Co. says it has now invested $5 million in its solid-fuel facility near Bacchus, Utah, and that employment at this plant will rise to 3,000 or more within the next few years. Right now, this unit is starting initial propellent testing—reportedly, in connection with the Air Force's Minuteman ICBM project; but Fred Hakenjos of the company's Chemical Propulsion Dept. says Hercules has given the Dept. of Defense several other proposals for work that could be done at the Bacchus site.

Continual Reappraisals: Pointing up the Pentagon's continual re-evaluation of high-energy-fuel projects were last week's reports about the boron fuels plant Callery Chemical Co. is building for the Navy at Muskogee, Okla.

In its original and most extreme form, the gossip was to the effect that the Navy was terminating this project. This was vehemently denied; Callery told *CW*, "A minor boiler mishap in mid-December delayed the startup of one unit at the new Muskogee plant, but startup of the entire Hi-Cal fuels facility will begin close to schedule within a few months."

Navy officials told *CW* '60 production requirements for Hi-Cal fuel were cut back. Previously, the Navy had planned to have the Muskogee plant running at full capacity in the '59-'60 fiscal year; now the schedule calls for

Rockets Ahead

operation at less than full-blast capacity. The Navy specifically disclaims any implication that it finds the Callery boron fuel less satisfactory than that made by Olin Mathieson.

It appears that some big decisions concerning the whole boron fuels program may be in the making. A conference—among high-ranking Air Force, Navy, Olin Mathieson and Callery officials—was under way late last week at Niagara Falls.

One line of speculation: that the Navy wants the Air Force to enter the Muskogee project as cosponsor, sharing the costs and taking some of the output. The Pentagon would neither confirm nor deny this. The Air Force shows a marked lack of enthusiasm for the plan.

Competition Looms: But both Olin Mathieson and Callery had a new worry this week: the possibility of stiffer cost competition, stemming from Stauffer-Aerojet's claims concerning low production costs.

Unofficial talk about the new Stauffer-Aerojet plant, already under construction on Aerojet's 20,000-acre facility near Sacramento, is that it can almost be regarded as a semiworks plant—despite its low cost, much lower than that of any other boron fuel plant to date.*

Capacity is estimated at 100 lbs./day of finished fuel, about 3,000 lbs./month—not much in terms of flying time for large aircraft or missiles, but enough to prove out a process.

Key to lower production costs in the Stauffer-Aerojet process is believed to be the recycling of reactants. This eliminates the need for discarding or collecting and repurifying by-product and unreacted material.

If this process actually turns out boron hydrides at a cost not much greater than the cost of the borax ore, profitable nonmilitary opportunities for these compounds might be opened. If cost can be brought down, boron hydride makers will not have to look far for potential civilian applications—a spate of possible uses are known.

*Construction costs on the other plants: OM's Air Force plant at Model City, N.Y., $45 million; Callery's Navy plant at Muskogee, $38 million; OM's privately owned plant at Niagara Falls, $5.5 million; OM's Navy plant at Model City, $4.5 million; and Callery's privately owned plant at Lawrence, Kan., $5 million.

'58 Recap: Setbacks, But Not for All

(million dollars)

Company	'58 Sales	Change from '57	'58 Earnings	Change from '57
American-Marietta[3]	$251.4	+ 7.4%	$17.6	+ 2.3%
American Potash[4]	48	+12%	4.3	— 8.5%
Diamond Alkali[4]	114.2	— 7%	6.5	— 8%
Dow Chemical[3]	640.9	— 2.6%	45.1	—21.6%
Du Pont[4]	1,825	— 7%	190[5]	—30%
Federal Chemical[2]	not reported		0.3	—33%
Harshaw Chemical[1]	60.1	— 9.1%	1.8	—23.2%
Hooker Chemical[3]	125.5	— 2.2%	10.6	— 4.9%
Interchemical[4]	109.5	— 0.4%	3.9	none
Lilly, Eli[4]	180	—10%	23	—28%
National Distillers[4]	524.3	— 2.6%	20.1	—12.7%
Parke, Davis[4]	172	+ 6%	27.9	none
Pfizer, Chas.[4]	222	+ 7%	23.8[6]	+ 4%
Staley Mfg.[1]	156.9	+ 3.0%	5.7	+11.1%

[1]For fiscal year ending Sept. 30; [2]For fiscal year ending Oct. 31; [3]For 12 months ending Nov. 30; [4]Preliminary and unaudited figures for calendar year; [5]Estimate. Does not include Du Pont's General Motors dividends. [6]Estimate.

For '59: Great Expectations

Great expectations for '59 are expressed in management comments accompanying nearly all of the early and unaudited synopses of '58 CPI business. Many came out this week.

The first handful of these preliminary reports indicate that the recession jolted diversified producers of industrial chemicals much harder than it hit chemical specialty makers. The pharmaceutical industry was barely grazed (*table*). But the broad-based chemical firms are among the most optimistic.

Magnesium in Sharp Comeback: Dow President Leland Doan says the last quarter of '58 was one of the company's best in terms of sales volume. Magnesium has made the greatest recovery from early '58 lows and appears to have the best potential for further growth, percentagewise, Doan adds.

Du Pont, too, reports notably increased sales in the fourth quarter; and looks for further rises this year —a $2-billion sales total seems to be in reach for '59. And Du Pont says it will spend nearly $200 million on expansion this year.

High Hopes for Polyolefins: Although National Distillers and Chemical Corp.'s total sales dipped last year, chemical sales were up from '57.

Rising business in polyethylene—and prospects for other polyolefins—may be ND's chemical aces for the near future. Polyethylene has become this company's most important chemical product; shipments increased last year to about 100 million lbs., and the target for '59 is 130 million lbs.

Two of the early-reporting companies are pinning part of their hopes for '59 on rival chlorate plants just reaching startup stage in Mississippi. American Potash & Chemical says its $4.3-million sodium chlorate plant at Aberdeen went onstream last week and delivery of finished product will begin next month. APCC says the 15,000-tons/year output of the plant—designed for possible expansion or for conversion to manufacture of perchlorates—will make APCC the nation's biggest producer of chlorates.

Hooker Chemical says its HEF subsidiary—jointly owned with Foote Mineral—will complete in February its ammonium and lithium perchlorate plant at Columbus. Hooker's adjacent sodium chlorate plant—which was "substantially enlarged" in '58—is undergoing further expansion.

Ice chokes river at Pittsburgh

. . . Rampaging floods elsewhere

WIDE WORLD PHOTOS

Weather Whips Ohio Valley

Swirling torrents of rain and melting snows swelled Ohio River tributaries in the East and Midwest last week, bringing the worst floods seen there in almost a decade. Chemical plants, for the most part, however, came through in relatively good style.

In the thriving chemical center of Cincinnati, one of the hardest-hit areas, only chemical plant that went into temporary shutdown was the St. Bernard Works of Emery Industries.

The Miami Valley Laboratory of Procter & Gamble, sitting on high ground overlooking the rampaging Great Miami River, was not affected.

But floods in the Buffalo, N.Y., area caused shutdown of Allied's National Aniline Division plant after waters rose 15 ft., inundating two power plants. Curtailed production also was reported at Allied's General Chemical Division Plant and at Hanna Coke Corp.

Koppers' Buffalo and Follansbee, W.Va., plants were closed 1½ days because of pressure failures in water pumps—neither plant sustained damage.

Ice jams and high waters in the Pittsburgh region caused much inconvenience but little harm to chemical plants. Most steel mills were closed.

Koppers' Oil City plant, north of Pittsburgh, closed temporarily.

Most others in the vicinity—e.g., American Cyanamid, Columbia-Southern, Blaw Knox—were unaffected.

Aluminum Upbeat

Last week, Aluminum Co. of America Chairman I. W. Wilson predicted "at least" a 10% gain over '58's aluminum consumption. He also said aluminum usage could easily go 15-20% higher if business continues to pick up. Meanwhile, things are already beginning to move fast in that industry.

The British Treasury officially okayed take-over of British Aluminium by a Reynolds Metals-Tube Investments combine, ending a bitter battle for control of the big aluminum producer. At last count, Reynolds and Tube Investments had acquired close to 90% of outstanding British Aluminium shares. Alcoa, which earlier had offered to buy a one-third interest in the British firm, reluctantly withdrew its bid.

And later last week, major aluminum producers agreed to give small business first option on 10% of all metal turned out at plants expanded with government help during the Korean War.

The agreement, made between the companies and the General Services Administration, amends aluminum supply contracts drawn up during the conflict. These pacts gave the government first call on the metal for about five years. Companies involved: Kaiser Aluminum, Alcoa, Reynolds Metals and Harvey Aluminum.

In another development, Alcoa revealed plans to acquire Rome Cable Corp. If shareholders approve, Alcoa would get all assets of Rome in exchange for 355,226 shares of Alcoa common stock. Rome Cable, with annual sales averaging $47 million/year, operates plants in Rome, N.Y., Torrance, Calif., and Collegeville, Pa.

EXPANSION

Sulfite Liquors: Puget Sound Pulp & Timber Co. will install a 100,000-lbs./day spray dryer at its Bellingham, Wash., mill. It's the major part of a $400,000 expansion program. The dryer will be used in production of waste sulfite liquor by-products. Bowen Engineering Co. (Long Branch, N.J.) is the contractor.

•

Alkanes: Arkansas Louisiana Chemical Corp., subsidiary of Arkansas Louisiana Gas Co., is blueprinting a $3-million expansion at its Hamilton extraction plant near Magnolia, Ark. The project, scheduled for completion by mid-'59, will add ethane recovery facilities, plus expanded capacity to recover propane, butane, isobutane, isopentane, natural gasoline and other natural gas liquids.

•

Botanicals: Meer Corp. (New York) has started construction of a new building to house its shipping and warehouse facilities, in North Bergen, N.J. On completion of the new building, these operations will be transferred from the company's research and processing laboratory in North Bergen, which will be expanded to increase production by 60%.

•

Pharmaceuticals: A. H. Robins Co. (Richmond, Va.), drug manufacturer, reports it has an option to buy 265 acres of industrial property near Richmond for possible expansion.

Earlier, the company purchased a 12½-acre tract in Richmond where it reportedly will build a new research laboratory, warehouse and office (*CW, Jan. 24, p. 25*).

•

Sulfuric Acid: Allied Chemical's General Chemical Division will boost sulfuric acid capacity at its Richmond, Calif., plant. New construction will begin immediately. A spokesman said the plant is being expanded to meet increased demands throughout the area. Cost was not revealed.

•

Rubber: General Tire & Rubber Co. will start construction this March on a new, $9-million tiremaking plant near Mayfield, Ky. Startup is slated for mid-'60. The new unit will employ about 1,000 persons.

COMPANIES

Johnson & Johnson has acquired McNeil Laboratories Inc., Philadelphia ethical-drugs maker, through an exchange of stock. Terms of the transaction were not revealed.

•

Algom Uranium Mines Ltd. (Toronto, Ont.) has applied to the U.S. Securities & Exchange Commission for registration of 822,010 common shares. The stock is issuable to holders of stock purchase warrants who may buy the shares for $11 each up to March 2, '59.

Algom—a Rio Tonto affiliate—owns and operates uranium mining properties in the Bline River-Algoma area on the north shore of Lake Huron in Ontario.

•

Universal Oil Products (Des Plaines, Ill.) will offer 2.9 million shares of stock for public sale. Date of the sale and offering price have not been disclosed. However, the stock will be sold through an underwriting group headed by Lehman Bros., Smith, Barney, and Merrill, Lynch, Pierce, Fenner & Smith.

Sale actually will be on behalf of Universal Oil Processes, a firm organized by underwriters to acquire the assets of UOP. Surviving corporation, after the sale, will be Universal Oil Products.

•

Central Farmers Fertilizer Co. (Chicago), for the time being, has dropped plans to produce calcium metaphosphate at its $16-million plant near Georgetown Canyon, Ida. Reportedly prompting the move: higher-than-expected startup costs, changes in requirements of member cooperatives, and a need for a less complicated method of producing the metaphosphate.

FOREIGN

Chemicals/Egypt: German, Italian and U.S. companies are in various stages of setting up chemical and pharmaceutical ventures in Egypt.

• The Italian-owned Phosphate Co. at Kosseir, in Upper Egypt, will be granted additional licenses to develop phosphate mines on the Red Sea coast and in southern Egypt. In return, the company's owners will permit Egyptian business organizations to invest in the enterprise.

• A West German consortium—made up of Badische Anilin, Uhde and Citra—has signed a contract to supply and erect the fourth and final unit of the fertilizer plant at the Aswan Dam site. This will bring total initial ammonium nitrate capacity of the plant to 400,000 tons/year.

Another West German group—headed by the Krupp organization—has contracted to supply the machinery and handle construction of the United Arab Republic's first pulp and paper mill.

• Chas. Pfizer & Co. (New York) is negotiating with the Egyptian Ministry of Industry for establishing an antibiotics compounding plant in Cairo.

•

Maleic Anhydride/England: Monsanto Chemicals Ltd. has contracted for construction of a 15-million-lbs./year maleic anhydride plant—said to be the largest outside of the U.S.—at Newport, Monmouthshire. Scientific Design Co. and SD affiliates will undertake the entire turnkey project, using an SD process. Completion goal: 1960.

"their surface-active, polymer, glass-bonding, bacteriostatic, and fungistatic properties are of special interest"

Q. Mr. Mulholland, you mentioned that these compounds are surface-active?

A. Yes, they are suggested for dispersing pigments or other solids in a variety of non-aqueous systems.

Q. What polymers are made from Alkyl Boric Acids?

A. Polymers prepared from organosilanediols and Alkyl Boric Acids have been patented. The alkyldihydroxyborane structure should be useful for building other special polymers.

Q. Are the Alkyl Boric Acids like the silicones in any way?

A. They appear to bond to glass surfaces in a manner similar to the silane diols. This property suggests, among other possibilities, that the Alkyl Boric Acids might be used as lubricants for glass fibers.

ALKYL BORIC ACIDS...R-B(OH)(OH)

Ramon A. Mulholland
B.S., M.S., Indiana University
Manager, Marketing, Callery Chemical Company

Q. Are these materials bacteriostatic or fungistatic?

A. Both. Tests indicate that at 10 ppm Nonyl Boric Acid markedly inhibits a soil fungus that rots pineapple roots. Other screening tests show that Nonyl Boric Acid completely inhibits growth of three bacteria and three molds in dilutions as high as 1:25,000 and has some effect even at 1:1,000,000.

Q. How about the present and future availability of the Alkyl Boric Acids?

A. At present, Nonyl and Dodecyl Boric Acids are obtainable in research quantities, with production of larger quantities at Callery's Lawrence, Kansas plant to follow.

Q. Can other Alkyl Boric Acids be made?

A. Various Alkyl Boric Acids can be made with different alkyl, cyclic, and functional groups. If you expect that a particular compound might have the right properties for your product or process, we would like to hear from you.

Q. Are these materials stable to hydrolysis?

A. Nonyl and Dodecyl Boric Acids appear to be quite stable to either acid solutions or alkaline aqueous solutions at ordinary temperatures. Autoclave conditions, about 150°C, are required for hydrolysis.

Q. What industries might use these compounds?

A. In the manufacture of paper for control of certain bacteria. In paints, leathers, polymers, resins, textiles, plastic-coated fibers, and detergent formulations to minimize bacterial damage, and many others.

CALLERY
CALLERY CHEMICAL COMPANY

Write or phone for specific information on the Alkyl Boric Acids.
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9600 Perry Highway, Pittsburgh 37, Pennsylvania

Washington
Newsletter

CHEMICAL WEEK
January 31, 1959

The course of upcoming Congressional investigations of business is now being determined.

Edwin G. Nourse, top economic advisor to former President Truman, says Congress should take prompt action in dealing with "aggravated" concentrations of power. His two examples: General Motors Corp. in the corporate field and the teamsters union in the labor field.

Nourse's suggestions topped off the opening round of economists' testimony heard by the Senate Antitrust & Monopoly Subcommittee, headed by Estes Kefauver (D., Tenn.). Kefauver, getting the jump on other committees lining up to study inflation, called a three-day session to hear economists suggest ways of controlling inflation and economic concentration in industry.

It's the start of Kefauver's new round of hearings into so-called "administered prices." His theory: that prices are moved up in concentrated industries with little or no regard to market factors such as supply and demand. According to Kefauver, this creates "administered price inflation" —and present antitrust laws seem useless in dealing with the problem.

The pharmaceutical drug field is one of the specific industry targets scheduled for treatment by Kefauver's group. It will be trying to show that manufacturers "manipulate prices upward," thus contributing to the high cost of living.

•

You'll hear a lot of squabbling over military procurement policy on Capitol Hill this session. Major issue is the increasing rate of contracting through private negotiation as opposed to advertised bidding. Congressional Democrats—notably Rep. Vinson and Rep. Hebert—argue against the trend, claim it concentrates defense business among fewer firms.

That' why odds are slim for passage of Sen. Saltonstall's highly touted bill to overhaul military buying practices. The new bill would provide for still more negotiated procurement and for wider use of "weapon system" management, under which prime contractors are given stronger powers over selection of subcontractors.

•

Eisenhower's $20-million budget figure for sewage works is already under Democratic attack. Rep. John A. Blatnik (D., Minn.), author of the $50-million program now on the books, is ready to introduce a bill raising the federal ante to $100 million/year.

Blatnik's new proposal would raise the minimum grant for any one project from $250,000 to $500,000. Moreover, it would permit small

communities to pool their grants for building an integrated sewage control facility to serve all. The Minnesotan also wants to give rapid tax write-offs to business firms for any industrial waste-treatment facilities they build.

This is a strategic move on Blatnik's part. He doesn't anticipate getting the $100-million figure, but he does hope to generate enough political heat to force the Administration to up its $20-million pool to the $50 million ceiling that present law permits.

•

A probe of the cosmetics industry's advertising practices has been diverted. Reshuffle of the House Government Operations Committee has deprived Rep. Blatnik of his far-ranging investigating subcommittee. This is the same group that held much-publicized inquiries in the past on such things as cigarette advertising and the claims of tranquilizers, weight-reducing preparations and toothpaste.

Blatnik had set his 1959 sights on cosmetics. He will try to get another subcommittee to do the job, but there's virtually no chance that will happen.

•

The door is still open for some Russian-U.S. trade, despite the failure of Mikoyan to effect any change in U.S. policy. This is clear from recent deals—for instance, the one in which a Boston firm is importing school laboratory equipment at prices far below market price for identical U.S.-produced items.

Washington isn't much concerned about such imports; there is no hint of illegality about them. A flood of Soviet imports of a given kind would produce official concern only if it appeared that the imports clearly amounted to Soviet economic warfare against a defense-essential U.S. industry.

The equipment deal was quickly and simply arranged, according to the importing company, Ealing Corp. (Cambridge, Mass.). Duty on such goods runs to 40-45%—but at Russian prices this rate is no handicap whatsoever.

Chemical industry opposition to sales of production equipment to the Russians is a big reason why there'll be no easing on goods going to them from the U.S. Washington officials say that the chemical industry's attitude surely helped keep any groundswell from growing in favor of more sales to the U.S.S.R.

•

TVA's conduct of its fertilizer programs gets a complete okay from the General Accounting Office, the watchdog agency that reports to Congress. Comptroller General Campbell notes: "The TVA act is very broad in scope and affords TVA considerable discretionary authority in carrying out its fertilizer and other agricultural activities."

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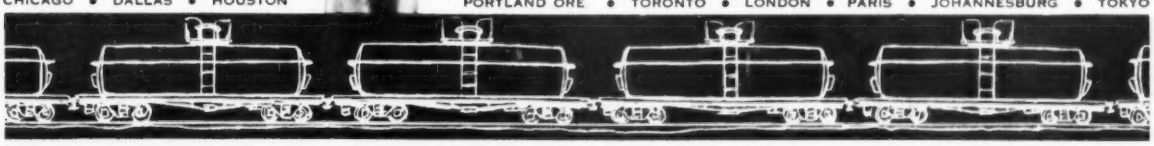
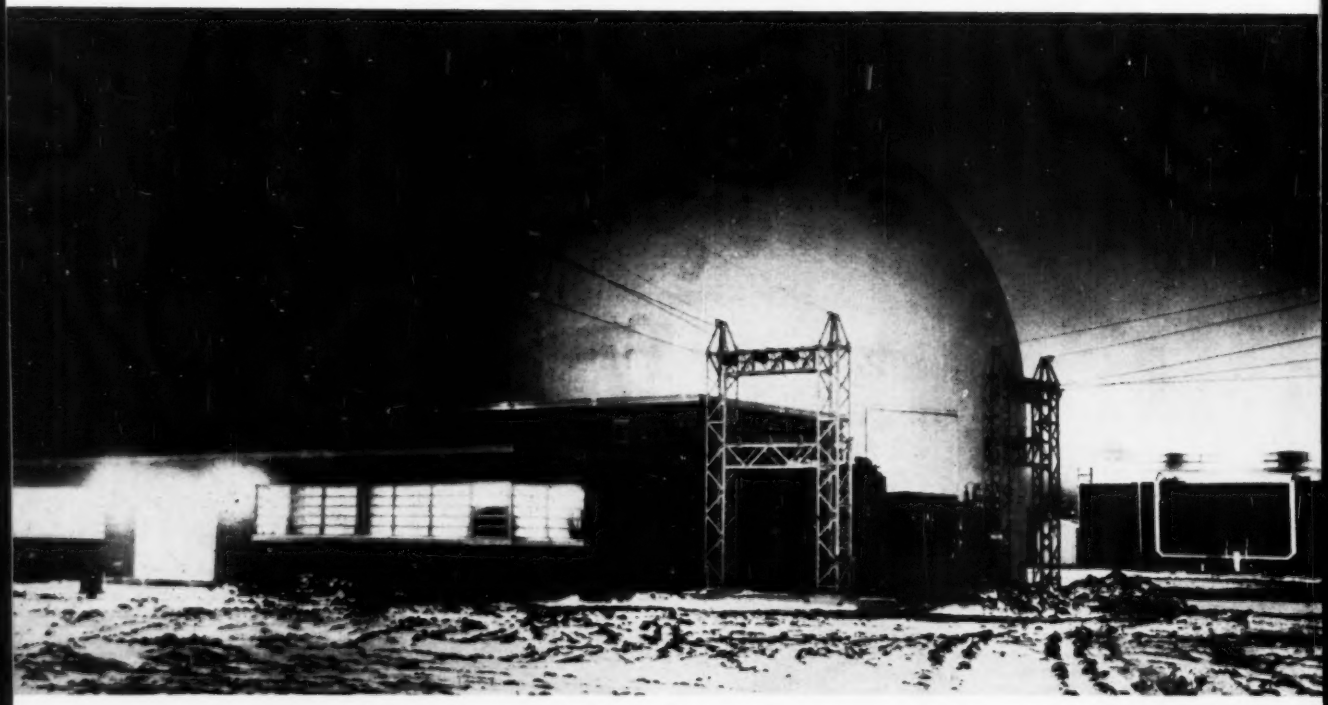


Small prototype reactors win edge over . . .



AEC policy committee believes small reactor systems, like Argonne National Laboratory's EBWR (left)

A-Power Outlook—More Emphasis

In a newly released report, AEC's ad hoc committee on Reactor Policies and Programs took a firm stand on the question of how to speed the long-awaited arrival of economically competitive nuclear power. The committee's recommendation: put more development dollars into small prototype reactors, less into large, high-cost/kilowatt demonstration plants.

While generally endorsing the aims of four tentative atomic power development programs put forth last December by AEC, Edison Electric Institute, General Electric and the Congressional Joint Committee on Atomic Energy, the *ad hoc* committee report takes issue with two points in the Joint Committee's proposal: (1) in addition to recommending more support for prototypes (the joint group suggested construction of about 1 million kw. of nuclear power capacity, and the *ad hoc* committee, only about half that amount); (2) the report sanctioned greater emphasis on breeding reactor systems than provided under the Joint Committee's program.

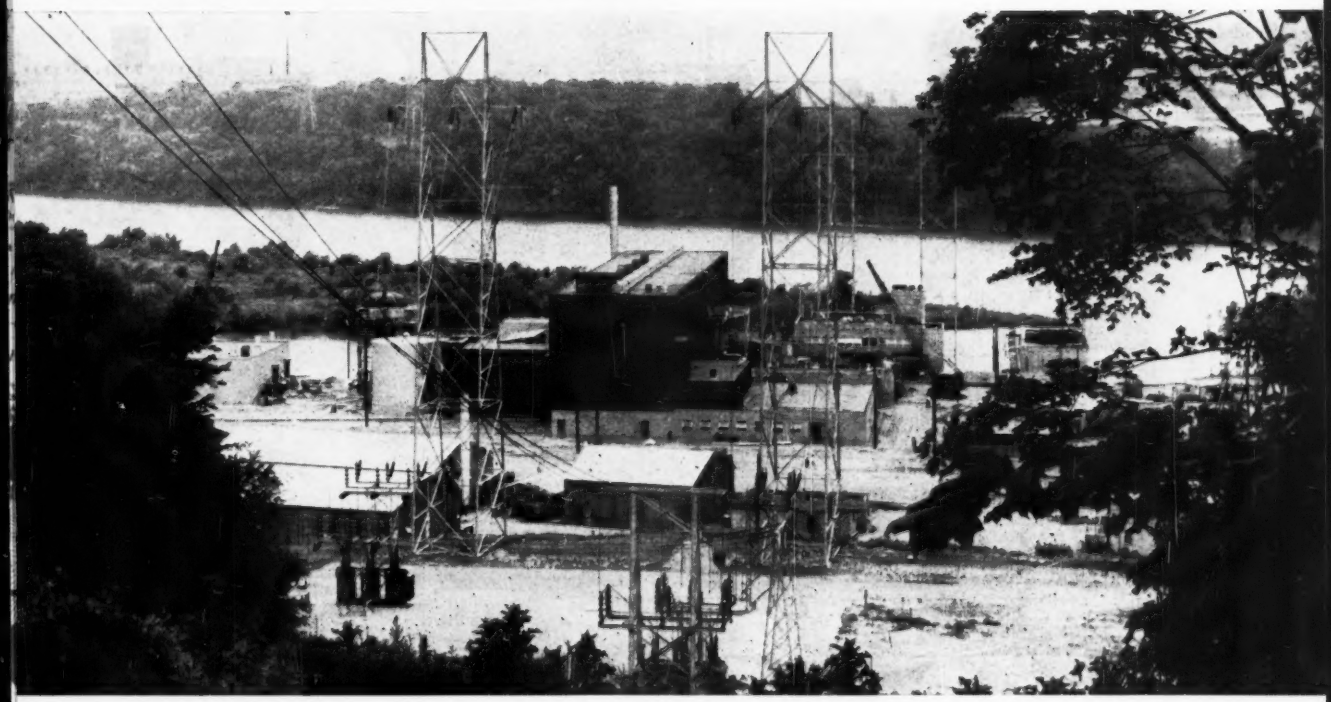
The AEC committee's reasoning is based, in part, on the relative lack of economic justification for large-size nuclear power plants in the U.S., and on the far greater need for solving technical problems and lowering costs. According to the report, ". . . information obtainable from so-called second- or third-generation power plants of 200-emw. (electrical megawatt) capacity can be obtained more quickly and more cheaply from second- or third-generation prototypes of up to 80-emw. capacity. The need for demonstrating the feasibility of large-scale plants has passed; such plants should be built only when their costs are low enough to be acceptable to utilities."

Since the 200-emw. installations are rapidly nearing this acceptance stage in western Europe, says the committee, the need to build them in the U. S. is further reduced.

Dollar Savings: The total cost of building 50-emw. prototypes in place of the 200-emw. plants projected over the next seven years is estimated at $200-225 million/year. Construction of the large facilities would be about $50 million higher—about $250-275 million annually. And private industry might be more willing to contribute to building the smaller plants, thereby reducing the government's support burden to an estimated $150-200 million/year.

The *ad hoc* committee re-emphasized AEC's basic responsibility for the conduct of nuclear research and development programs, but expressed the hope that at least some of the prototypes will be privately financed

large demonstration power plants



will foster power development faster than big demonstration units like the Shippingport PWR (right).

on Development, Less on Kilowatts

and, of course, privately owned.

Cost Key: Turning to the technical problems to be studied in the proposed prototype power plants, the committee put strong emphasis on fuel-cycle development as a key to cost cutting. Fuel preparation, fabrication and reprocessing determine, to a large extent, the operating costs of the system. The fuel also influences capital costs by imposing certain requirements on the over-all design of the system.

Technical problems of fuel-system development are complicated by the interaction of many factors, says the report. Therefore, a short-range solution of one problem may give rise to other problems that, in the long run, would outweigh its apparent advantages.

For example, the use of unconventional coolants, such as sodium or high-pressure helium, could yield higher thermal efficiencies and higher specific power. But because of the lack of commercially available materials and equipment for handling such coolants, capital costs of reactors employing them are higher than those of more conventional water-cooled systems.

In the long run, these extra costs may be whittled down as reactor engineers gain experience in handling new materials. There's evidence that this has already started in the case of sodium, currently being groomed for use in commercial power plants designed by Atomics International for Consumers Public Power District's sodium-graphite reactor at Hallam, Neb., and by Nuclear Development Corp. of America (White Plains, N.Y.) for Chugach Electric Power Assn.'s sodium-deuterium reactor (*CW, Dec. 6, '58, p. 69*) at Anchorage, Alaska.

The situation is more acute, however, in the case of such radically different fuel systems as fluid-fuel reactors. Here the potential operating advantages must be weighed against the tremendous expense of developing the fluid-fuel system to the point where its performance can be compared with that of more conventional systems.

A case in point is the Armour Dust Fueled Reactor, which has been under development at Armour Research Foundation (Chicago) since February of last year. ARF engineers are sold on the ADFR concept, report that it affords all the advantages of a fluid-fuel system without the traditional materials and corrosion problems, permits high-temperature operation for good heat utilization and operating efficiency, and presents a very compact installation. Despite these promising prospects, AEC did not renew ARF's research contract that expires

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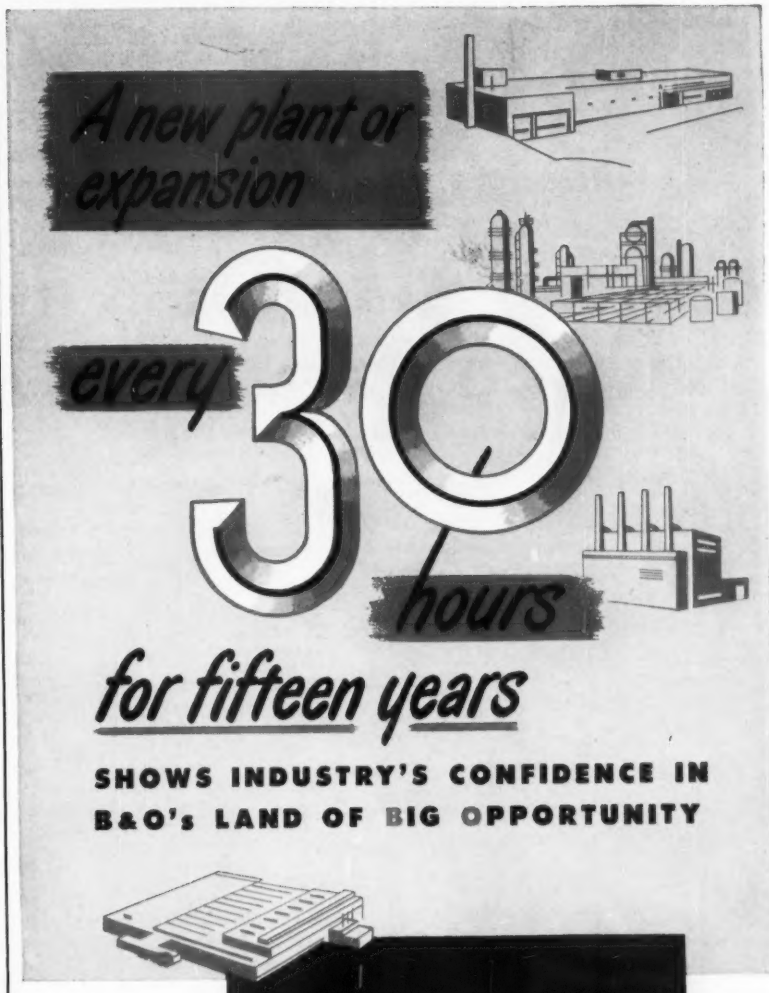
next month. Further development of the ADFR will likely be suspended until ARF obtains private industrial support for the project.

Reactor Materials: The chemical process industries have a considerable stake in research and commercial development programs devoted to large-scale production of special nuclear materials. Here, according to the *ad hoc* committee report, are some of the problems that will largely determine the success or failure of these products:

- Zirconium still faces stiff competition from stainless steel. Short-range considerations favor stainless slightly for its relative ease of fabrication and greater experience in commercial applications. However, the use of stainless steel exacts a penalty in terms of higher fuel enrichment and lower conversion ratios, thereby increasing fuel-cycle costs. Zirconium, on the other hand, possesses excellent nuclear properties, is accorded a good chance to win out over stainless as experience uncovers ways to cut high fabricating costs.
- Heavy water has several advantageous nuclear properties to recommend its use. But the lower fuel-cycle costs achieved by the use of very high irradiation levels and low-enriched fuel in a heavy-water-moderated reactor may be more than offset by the capital costs of the heavy water itself and of the containment equipment that's needed to prevent leakage losses.
- Organic moderator-coolants are less corrosive, permit the use of higher temperatures and lower pressures than do water-cooled systems. Disadvantages: lower heat-transfer, vulnerability to irradiation damage.
- It will be necessary to use thorium and plutonium fuels to supplement uranium-235. This will require development of fast-breeder reactors for plutonium, thermal-breeder reactors (e.g., aqueous-homogeneous) for thorium. The committee recommended that target dates on breeder reactors be moved up, even to the extent of "crash" development programs.

Although there's still a long way to go, the committee predicted that nuclear power will be competitive with fossil fuels in some parts of the U.S. within the next 10 years, and in most parts of the country within 20-30 years.



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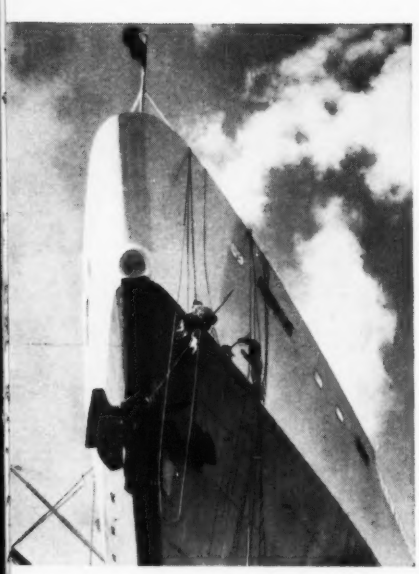

THE SHIP'S A TRAMP, but "operation repaint" will soon have her looking smart as an ocean liner. In marine paints, quality is vitally important. That's why so many marine protective coating manufacturers—and other paint manufacturers, too—use Witco Aluminum Stearates. They depend on these stearates to improve pigment suspension, modify viscosity, reduce gloss and improve water repellency—factors essential for quality, long service life, reduced painting time and low costs. Witco's new Aluminum Stearate 119 finds use aboard ship, too, as waterproofing for manila rope. With this stearate, rope passes the conventional float test forty times better than with other stearates.

A THOUSAND WORDS ON Witco Calcium Stearate. Hundreds of thousands, in fact, for Witco Calcium Stearates are extensively used in paper-coating formulations to increase water resistance, improve flow properties, impart necessary flexibility and to insure maximum gloss and brightness. Other Witco stearates are used in printing inks to improve suspension and thickening and to reduce excessive tack.

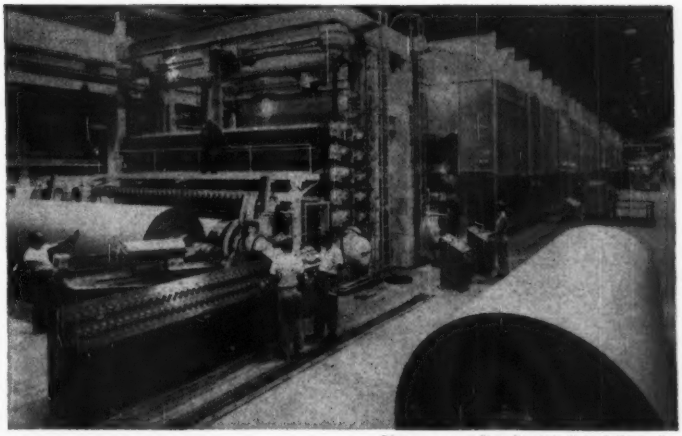

Photo courtesy West Virginia Pulp & Paper Co.

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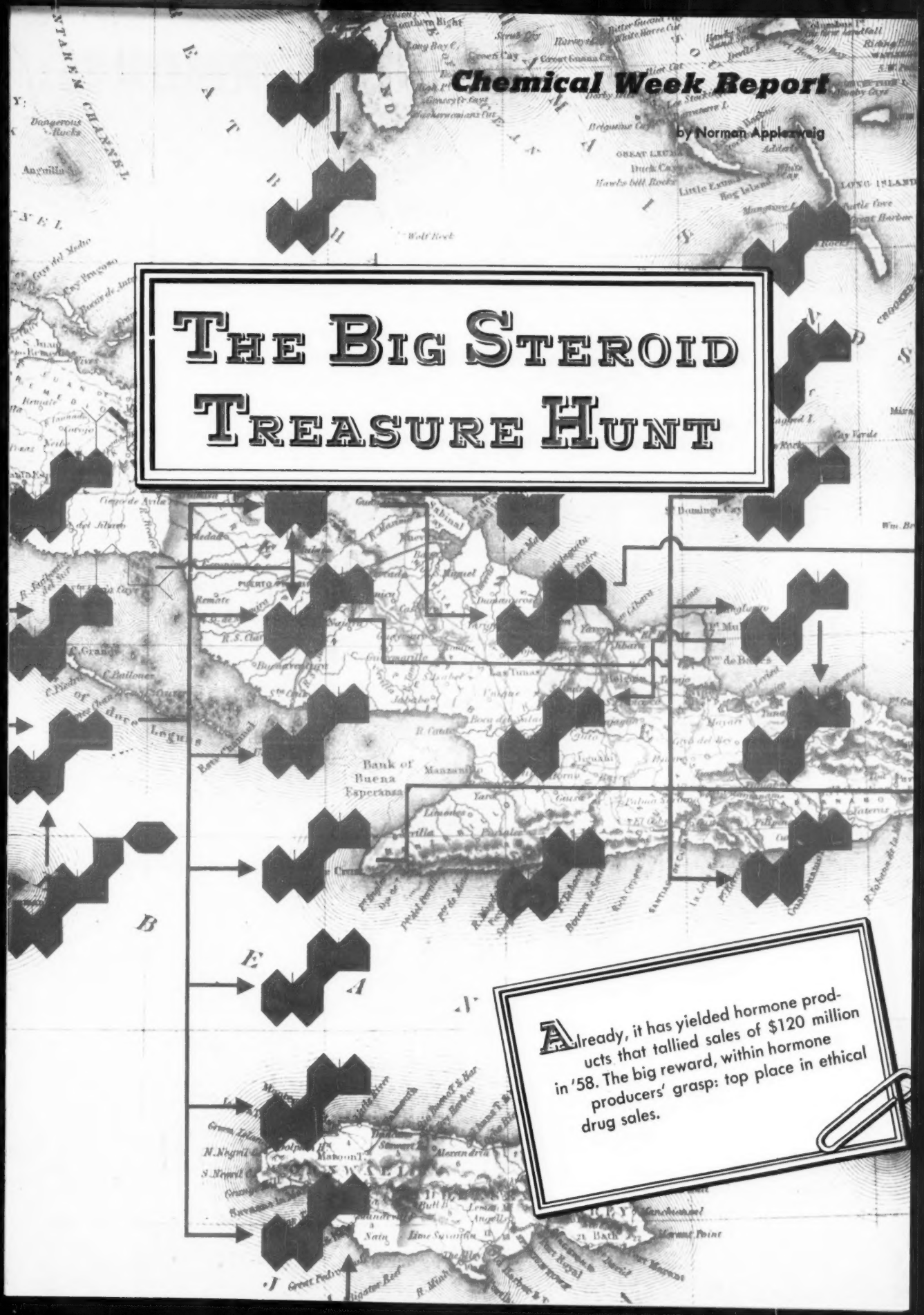


Chemical Week Report

by Norman Applezweig

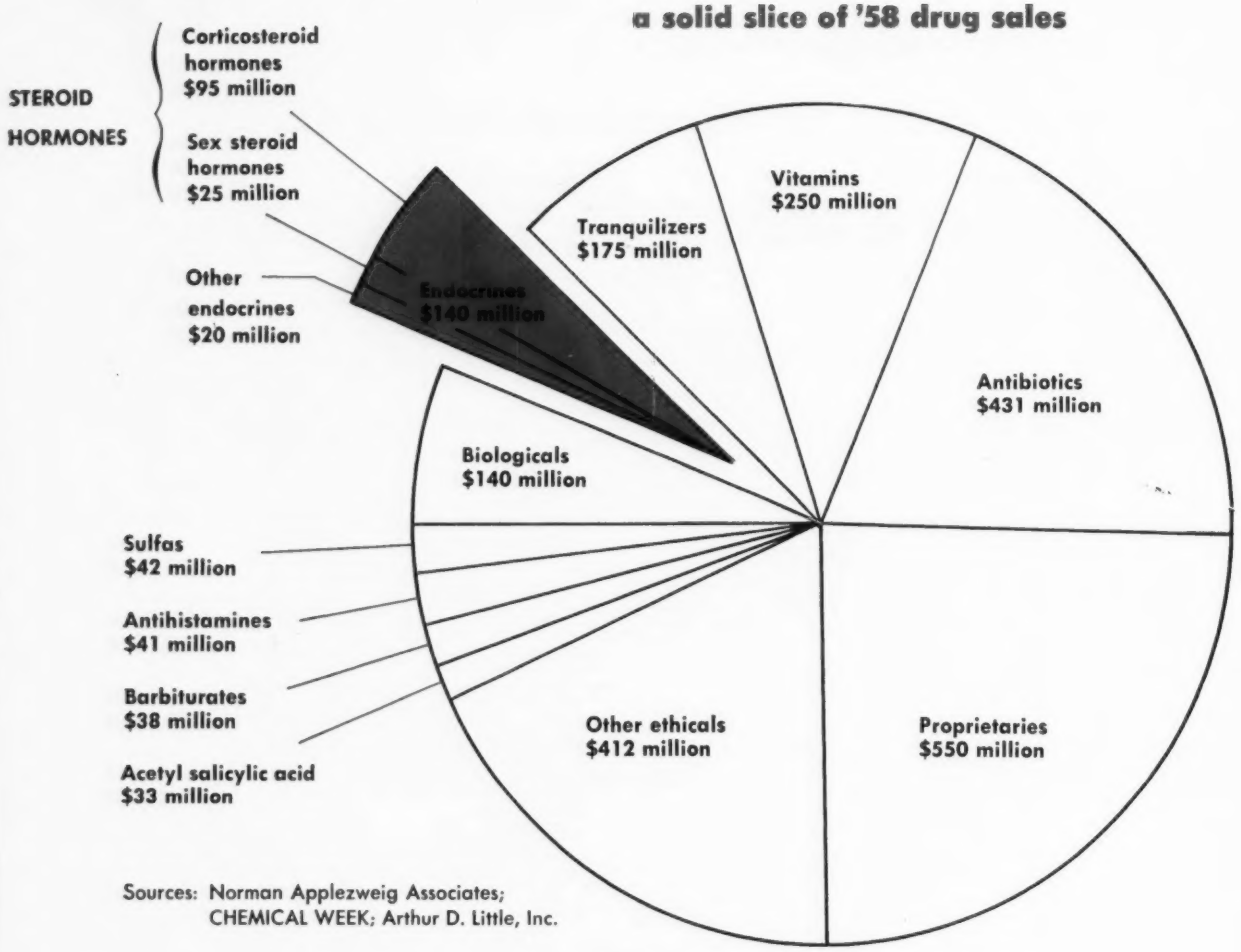
The Big Steroid Treasure Hunt

Already, it has yielded hormone products that tallied sales of $120 million in '58. The big reward, within hormone producers' grasp: top place in ethical drug sales.

CW Report

STEROID HORMONES:

a solid slice of '58 drug sales



Sources: Norman Applezweig Associates; CHEMICAL WEEK; Arthur D. Little, Inc.

1958 Estimated Pharmaceutical Industry Sales: $2,252 million

THIRTY pharmaceutical companies in this country and abroad are embarked on a fabulous molecular treasure hunt—the search for new and improved steroid hormones. The treasure map traces a painstaking path over the four neatly positioned rings of the cyclopentanophenanthrene nucleus, basic geography of all steroid compounds.

Most natural hormones are built on this 17-carbon structure. A limited number of side groups arranged in a variety of ways give each compound distinct, and sometimes remarkable, physiological properties. Removing or altering the composition or position of these side chains changes the magnitude and nature of the physiological response.

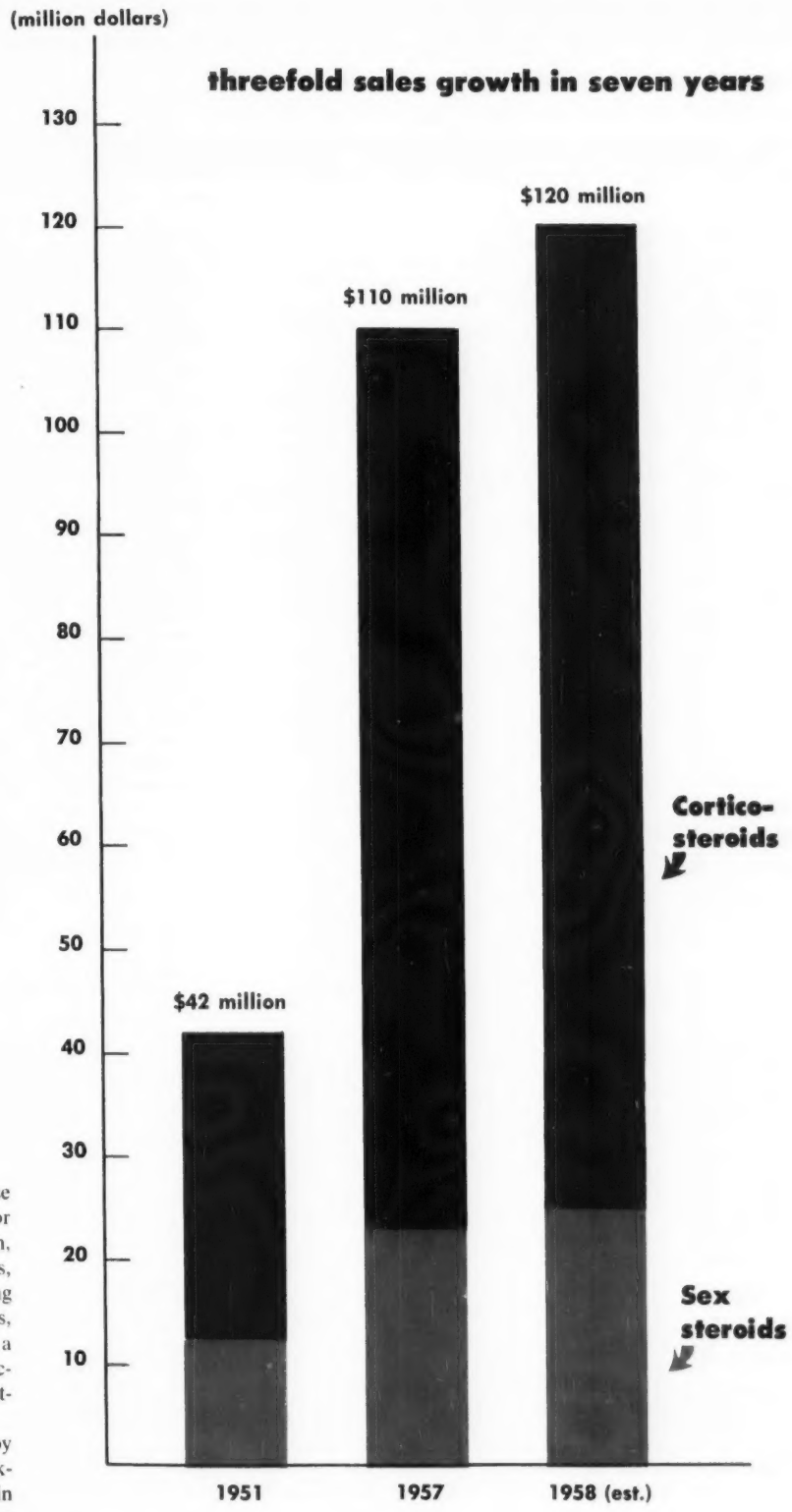
While myriad permutations and combinations are possible, there's a limit to the number of useful compounds that can be produced. Experience has taught that most new synthetic compounds will be physiologically inactive or unusable because of limited biological knowledge.

This searching and screening started with the discovery 30 years ago that steroids control sexual characteristics. After a vigorous research effort, the sex hormones were isolated, characterized, synthesized and made available for therapy. Later work showed that steroids could remarkably influence inflammation, anabolism, catabolism—in fact, the entire behavior of the cellular system.

Steroid research thus far has yielded hormone products that turned $120 million sales for U.S. pharma-

PLAYING FOR TOP PLACE IN THE DRUG MARKET

by Norman Applezweig



ceutical manufacturers in '58. These products include corticosteroids for treating arthritis and inflammation, sex hormones to offset deficiencies, progestational agents for combating menstrual and pregnancy disorders, anabolics for building tissue, plus a host of other drugs that serve functions ranging from cosmetics to veterinary medicines.

Synthetic cortisone (made by Merck in '49) was the big breakthrough into the fascinating domain of corticosteroids. It also presented a

Steroid Prospects in 10 Major Markets

Right now, three outlets—anti-inflammatory agents (corticosteroids) progestational agents and sex hormones—claim most of the research, production and marketing efforts of steroid producers. Research is the big factor in other promising markets.

MARKET	PRODUCTS
1. Anti-inflammatory drugs Corticosteroid sales will hit close to $95-million/year this year. Newer compounds such as methyl prednisolone, the "metis," triamcinolone and dexamethasone—all essentially free of undesirable salt retention effects—represent major breakthroughs in steroid therapy. Newer compounds that are free of organic side-effects are the major goal. Corticosteroid sales are expected to remain at high levels and increase steadily.	cortisone hydrocortisone prednisone prednisolone 9α-fluorohydrocortisone (Squibb's Florinef) 6α-methyl prednisolone (Upjohn's Medrol) triamcinolone (Lederle's Aristocort; Squibb's Kenacort) dexamethasone (Merck's Decadron; Schering's Deronil)
2. Progestational agents Within two years, the new orally active progestins have built to a $4-million/year market, part of the $25-million/year market for sex steroids. The application of progestational agents as birth control "pills" could lead to a wide market for this group of steroid hormones. This could become the biggest single market for steroid drugs. The R&D emphasis is on less expensive compounds that are efficacious and potent. Effects of long-term administration are being studied. Compounds that are long-acting with simple dosage procedures are being sought.	19-nor-17α-ethinyl testosterone (Parke, Davis's Norlutin) $\Delta^{5(10)}$-17α-ethinyl-17ß-hydroxy-3-ketoestrene (Searle's Enovid) 17α-hydroxyprogesterone caproate (Squibb's Delalutin; Schering AG.) 6α-methyl, 17α-hydroxyprogesterone acetate (Upjohn's Provera; Syntex) 6α-methy-21-methyl ethinyl testosterone (British Drug Houses) 21-fluoroprogesterone 6-methyl progesterone (British Drug Houses) 9α-bromo-11-ketoprogesterone (Squibb) 17α-bromoprogesterone 6-fluoroprogesterone (Upjohn; Syntex)
3. Anticancer drugs Sex steroids, definite factors in the control of genital tissue growth, were among the first chemotherapeutic agents used as suppressants in mammary and prostatic cancer. Nonfeminizing estrogens and nonmasculinizing androgens are being developed and clinically tested. Suppression of pituitary hormones by steroid antihormones is a major goal. To date, therapeutic effectiveness of steroids in cancer therapy is mainly palliative and delaying.	ethinyl estradiol estradiol testosterone androstane-17ß-ol-3-one (Pfizer's Neodrol) 19-nor testosterone 19-nor-17α-ethyl testosterone (Searle's Nilevar) Δ^4-11ß, 17ß-dihydroxy-9α-fluoro-17α-methyl-3-ketoandrostene (Upjohn's Halotestin) conjugated estrogens (Ayerst's Premarin) adrenal corticoids antiestrogens (19-nor allodihydro-17 alkyltestosterone) (Syntex) progesterone 9α-fluoro-11ß-methyl testosterone (Ciba's Ultandren) 9α-bromo-11-ketoprogesterone (Squibb's Braxarone)
4. Cardiovascular treatments Cardiovascular therapy is one of the biggest potential markets for steroid drugs. Specific steroids that influence fat mobilization, fat transport and cholesterol metabolism are under study. Steroid drugs to counteract edema, to lower blood pressure and to regulate heart rhythm have been synthesized. The underlying fault in atherosclerosis may be in mineral metabolism, leading to mineral deposits in blood vessels of susceptible individuals.	16-chloroestrone methyl ether (Searle's antiatherosclerotic) 16α-piperidine-5-pregnenolone 16-cyclohexylamino-allopregnandiol (Schering's antiaccelerator and antiarrythmic steroids) 17-(2-piperydylmethyl)-3ß, 17ß-androstanediol (Hoffmann-LaRoche's antifibrillator) 17α-proply-4, 5-dihydro-19-nor testosterone (Searle's hypotensive).

Table continues on page **42**

problem that threatened to strangle the new corticosteroid industry at birth. Until adequate supplies of raw materials (Merck was using ox bile) could be made available at reasonable cost, the future of this tremendously promising segment of the synthetic steroids industry would be highly tenuous.

Thanks to Upjohn's microbiological oxygenation process and other pioneering developments, the problem has largely been solved. Result: emphasis has shifted from the search for better raw materials to the hunt for new and better drugs.

Bolstering this effort is a conviction that steroid drugs are destined to capture first place in sales in the multibillion-dollar pharmaceutical market—surpassing antibiotics, vitamins and tranquilizers.

Formidable difficulties beset steroid producers in their drive toward this goal: complications associated with large-scale synthesis of complex molecules; physiological capriciousness of steroids (which require months and years to evaluate clinically); ultrakeen research and marketing competition.

More time, money and manpower is probably expended on steroid-oriented research, process development, clinical study and sales promotion than on any other single group of ethical drugs. Case in point: two weeks ago, Schering revealed that it had earmarked over 30% of its $7.5 million '59 research budget for hunting active new steroids. More top-notch scientists and clinicians are engaged in steroid research than in any other branch of drug science.

While steroid hormone producers have already scored fantastic market successes, the dollar return in this field doesn't yet begin to match that of antibiotics, for instance. But, while antibiotics are freely used throughout the world, steroid hormones haven't yet achieved broad acceptance, even in the Western world. Time and education will inevitably expand the steroid hormone market.

Fourth Place but Growing

In '58, total steroid hormone sales stood at an all-time high: $120 million. This ranks steroid hormones fourth among the big ethical best-sellers. Antibiotics are in first place at an estimated $431-million sales in '58; vitamins are runner up at about $250 million; tranquilizers are third at around $175 million (*see chart pp. 38-39*).

Steroid hormone sales have grown at nothing short of a spectacular pace. In '51, two years after Merck introduced cortisone, the anti-inflammatory drug market hit $30 million in sales volume. Sex steroids—drugs for treating endocrine deficiencies—added another $12 million in sales. This put the total market for steroid hormones that year at $42 million.

By '57, steroid hormone ethicals had built to $110-million sales—$87 million for corticosteroids, $23 million for sex steroids. Last year's sales record was a new high at $120 million—$95 million for the corticosteroids, $25 million for sex steroids.

Over the '51-'58 span, sales at the pharmaceutical manufacturers' level have increased at an average annual clip of 26%. This becomes all the more impressive when two additional facts are taken into consideration: (1) potencies of the newly introduced drugs have been steadily increasing; (2) unit prices for all steroid finished products have been steadily decreasing. Look at some statistics:

Corticosteroid dosages per tablet (hence, the weight of active ingredient per tablet) have tumbled over the years: '49—cortisone, 25-mg. dose/tablet; '54—hydrocortisone, 5-mg. dose/tablet; '57—methyl prednisolone and triamcinolone, 4-mg. dose/tablet; '58—dexamethasone, 0.75-mg. dose/tablet.

Steroid hormone bulk prices also follow the pattern. Cortisone started out costing over $200/gram, fell to about $2/gm. in '57. Progesterone, important as a sex hormone and intermediate, sold at $12/gm. in '47; by '57, the price was 15¢/gm. Testosterone, another sex hormone, now sells for about 35¢/gm., a drop from its $30/gm. price in '47. Estrone, another sex hormone and now key intermediate for 19-nor progestational agent synthesis, took a big drop from $100/gm. to $3.50/gm. over the '47-'57 period.

The Big Market: Corticosteroids

Close to 80% of today's market for steroid hormones is for drugs that counteract inflammation—the corticosteroids used for treating countless ailments, especially arthritis and other inflammatory conditions, including many skin ailments.

The race for supremacy in the corticosteroid field began with Merck's introduction of cortisone in '49. One year later, corticosteroid sales hit $13 million. Schering, then Upjohn in '52, followed Merck on the market with cortisone. Almost simultaneously, Merck, Upjohn, Pfizer and Schering jumped on the hydrocortisone bandwagon, helped to build the corticosteroids market to $50/-year by '54.

In '55, Schering made another major technological break-through with its prednisone and prednisolone, compounds with higher potency and fewer side-effects than either cortisone or hydrocortisone.

One year after the introduction of prednisone and prednisolone, the corticosteroids were ringing up $80 million in sales, with Schering's two new drugs accounting for more than $50 million worth of the take.

Late in '57, Upjohn surprised the industry with its new Medrol (methylprednisone), a prednisone analog with a methyl group substituted in the 6-position. Not to be outdone, Lederle and Squibb followed with Aristocort and Kenacort, respectively. Both are triamcinolone, a 16α-hydroxy, 9α-fluoro compound. Both companies cross-license one another's production

Steroid Prospects in 10 Major Markets

MARKET	PRODUCTS
4. Cardiovascular treatments *cont.*	20-(5'-methyl-2'-piperidyl)-5-pregnene-3ß, 20-diol (antiaccelerator) 20-bis-hydroperoxide of 3α-acetoxy pregnane-11, 20-dione (coronary dilator) 3-ß, 16α-dihydroxy allopregnan, 20-one (Ciba's aldosterone diuretic antagonist) 3-(3-oxo-17ß-hydroxy-4-androsten-17α-yl) propionic acid γlactone (Searle's diuretic)
5. Mental disease treatments, sedatives, tranquilizers, anesthetics Specific steroids that act on the central nervous system have already been found, indicating the potential for steroids in the sedative, tranquilizer and anesthetic markets. Altered responsiveness of schizophrenics to ACTH and adrenal steroids suggests that further applications of steroids may be found that can reverse metabolic derangement encountered in mental diseases.	dihydrodesoxycorticosterone sodium hemisuccinate (Pfizer's Viadril) Δ^5-androstene-3ß, 16α-diol (Lasdon Foundation's Cetadiol) pregnenolone 6ß-hydroxy-3:5-cyclopregnan-20-one (British Drug Houses' Neurosterone)
6. Anabolic agents Anabolic agents have the effect of building body tissue. They're used for premature infants, convalescence, injuries producing tissue loss and geriatrics. Nitrogen retention—a measure of tissue-building activity—is an inherent quality of the androgens. Extensive work is proceeding to develop compounds that have a high degree of tissue-building activity of the androgens without their masculinizing effects.	testosterone androstane-17ß-ol-3-one 17α-methyl androstendiol (Organon's Orgasterone) 19-nor, 17α-ethyl testosterone (Searle's Nilevar; Organon) 4 chlorotestosterone (Farmitalia's Steranabol; Syntex) Δ^4-11ß, 17ß-dihydroxy-9α-fluoro-17α-methyl-3 ketoandrostene (Upjohn's Halotestin)
7. Veterinary products Hormone feeds using stilbestrol (a nonsteroid compound with estrogenic activity) have already built a hefty market for themselves in veterinary fields. Steroids are now being used to improve feed utilization, increase quantity of animal carcass yield. In other areas, steroid hormones are being applied to regulate breeding cycles and prevent fetal loss. Milk production from nonpregnant heifers has been achieved with hormone injections. The veterinary drug market could become one of the biggest for steroids.	estradiol-progesterone (Syntex's Synovex-S) testosterone-estradiol (Syntex's Synovex-H) 17α-hydroxyprogesterone methyl androstendiol
8. Cosmetics Prevention of baldness in men and hirsutism in women are big potential steroid applications. Pregnenolone-containing skin cream has been patented as an aid to proliferation of skin layers; progesterone creams were recently released by FDA as aids to the "plumping" of skin tissue. Thousands of other steroid compounds are potential skin proliferators effecting permeability and water retention of the skin. For the most part, they are still untested.	estrone estradiol progesterone conjugated estrogens pregnenolone
9. Antibiotics, bacteriostats and fungistats Fungicidal steroids with antibiotic properties have been isolated. Estrogens show bacteriostatic, as well as fungistatic, properties. Further developments of fungal steroids may yield new antibiotics.	cephalosporin P helvolic acid 3ß-methoxy-17ß-hydroxy-Δ^5-androsten-17α-acetic acid Δ^5-pregnene-3ß, 20α-diol-3-methyl ether Δ^5-3ß-hydroxy-22 [N-piperidino]-bis-norcholine methiodide (Schering)
10. Hemostatics Intravenous injections of water-soluble estrogens are useful in a variety of bleeding disorders. Modified estrogens with high hemostatic and low feminizing potency are being sought.	conjugated estrogens (Ayerst's Premarin, Intravenous)

to avoid patent interference; Lederle controls the rights to 16α-hydroxy compounds and Squibb the rights to 9α-fluoro compounds.

In the latest move, Merck last year offered Decadron, (dexamethasone) a 16α-methyl, 9α-fluoro compound. Now Schering promises to market a competitive dexamethasone product, called Deronil, synthesized from sapogenins rather than bile acids (which Merck uses). There's a possibility that other companies may enter the dexamethasone picture under cross-licensing arrangements in the near future.

Almost every corticosteroid compound ever marketed remains in use today. Instead of bringing obsolescence, new and improved modifications enlarge total demand.

The sales outlook for corticosteroids is $120 million in '59. Sales should break down like this: prednisones and prednisolones, $43 million; cortisones, $33 million; triamcinolone and dexamethasone compounds, $44 million.

$25 Million for Sex Hormones

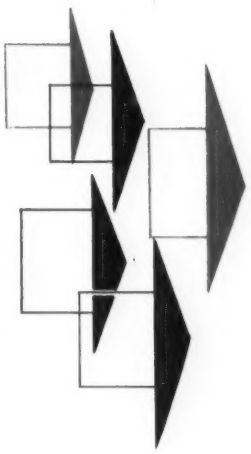
Sex steroids and progestational compounds, now 20% of the $120-million/year steroid hormone market so far haven't displayed as dramatic a sales rise as have the corticosteroids. Yet, the market is steadily building. It hit an estimated $25 million in '58, up from $12 million in '51.

But companies manufacturing the drugs anticipate making gains at a much faster clip. Industry spokesmen are looking for noncortico steroids (especially progestational agents and anabolics) to eventually rival corticosteroids in sales.

The newly introduced ('57) orally active progestins (e.g., Parke, Davis-Syntex's Norlutin and Searle's Enovid—19-nor compounds) are currently selling to the tune of an estimated $4 million/year. That's a remarkable record, considering their newness and their relatively high retail cost.

Although steroid hormone producers zealously guard the secrecy of their processes, it is possible to piece together a reasonably accurate flowsheet of commercial production routes. The chart on the following two pages is a completed jigsaw puzzle of definite information and educated surmises.

MANY PRODUCERS, MANY PROCESSES



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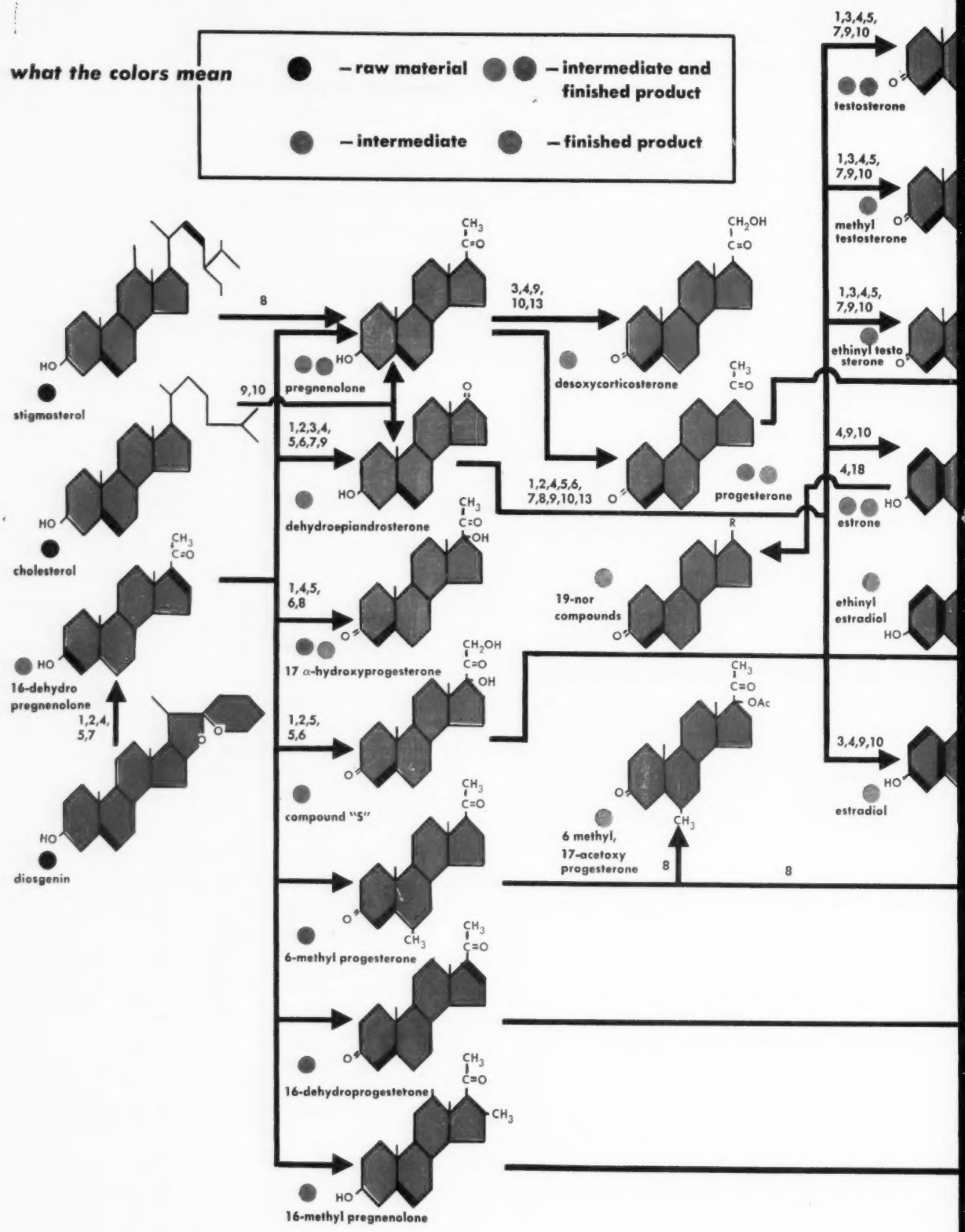
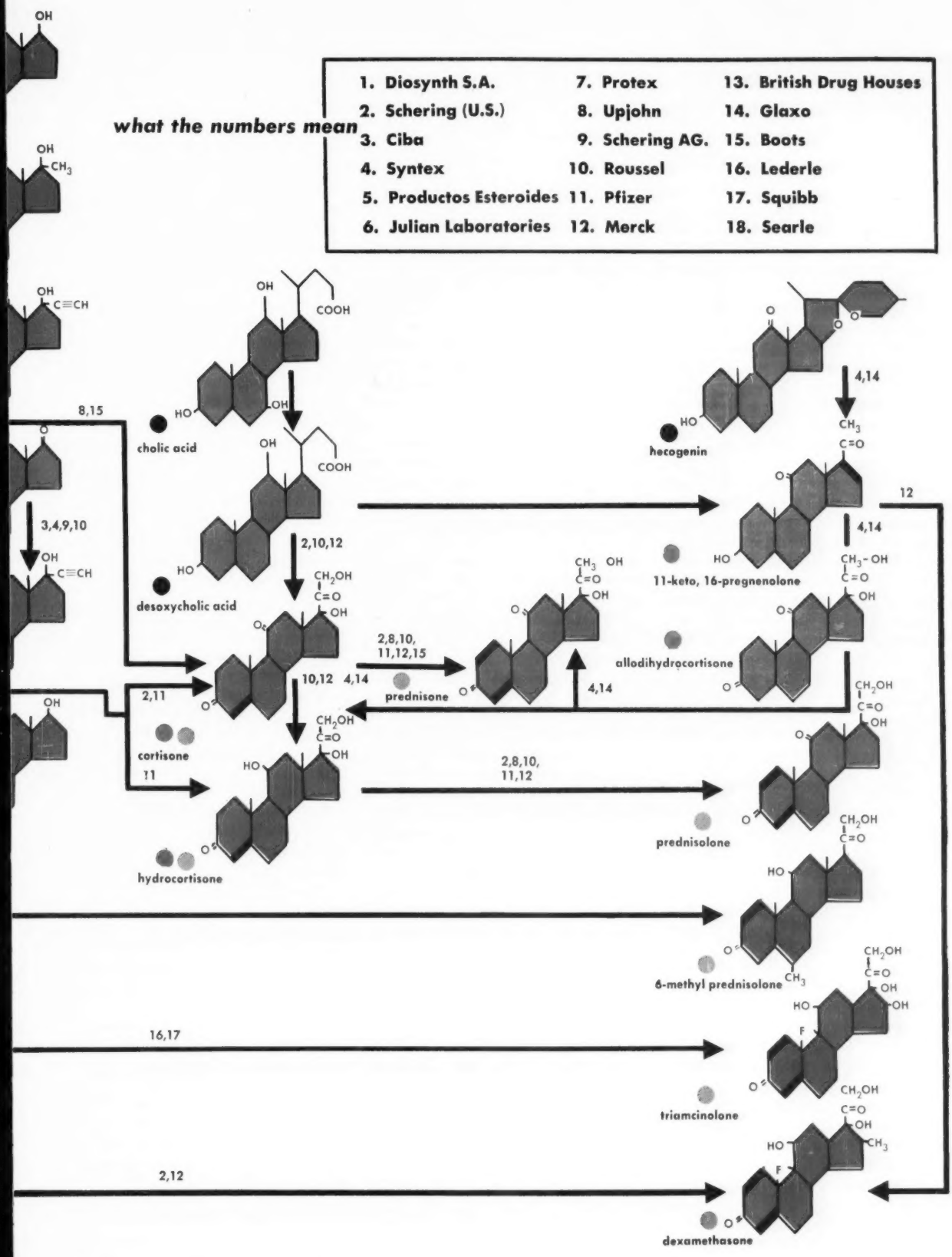
Which Production Route for What Producer?




what the numbers mean
1. Diosynth S.A.
2. Schering (U.S.)
3. Ciba
4. Syntex
5. Productos Esteroides
6. Julian Laboratories
7. Protex
8. Upjohn
9. Schering AG.
10. Roussel
11. Pfizer
12. Merck
13. British Drug Houses
14. Glaxo
15. Boots
16. Lederle
17. Squibb
18. Searle
cholic acid
desoxycholic acid
hecogenin
11-keto, 16-pregnenolone
allodihydrocortisone
prednisone
cortisone
hydrocortisone
prednisolone
6-methyl prednisolone
triamcinolone
dexamethasone
8,15
3,4,9,10
2,10,12
2,8,10, 11,12,15
10,12
4,14
2,11
11
2,8,10, 11,12
16,17
2,12
12

CW Report

Progestational compounds are more potent than natural hormones for controlling such ailments as threatened and habitual abortion, amenorrhea, functional uterine bleeding, premenstrual tension, dysmenorrhea and endometriosis—complaints suffered by an estimated 50% or more of the U.S. female population.

Their application as birth control pills could result in a major windfall for the industry—if current mass clinical trials prove conclusively that the compounds cause no harmful side-effects on extended use.

But U.S. and European steroid drug manufacturers are proceeding cautiously in this area. Companies are promoting the progestational agents not as contraceptives but as orally active progestins to replace injectable progesterone in the treatment of gynecological and obstetrical conditions.

Companies active in the progestational drug area, their products and tradenames appear in the table on pp. 40 and 42.

Possibilities for Profit

Several potentially big outlets outside major areas of steroid hormone therapy are currently being cultivated by producers. A list of these markets, companies working in the various areas, their products and tradenames are included in the table on pp. 40 and 42.

One of the most promising of these markets: domestic livestock fattening. The theory is that steroid estrogens can fatten livestock better and with less side-effects than synthetic steroid substitutes (e.g., diethyl stilbestrol). Syntex and Squibb, engaged in a joint R&D effort to develop this market, are offering combination steroid products for improving the utilization of animal feed.

With an eye to the increasing numbers of young and old members of the population, steroid hormone producers are giving added attention to anabolics (tissue builders) for geriatric and pediatric use. They're offering modified androgens intended to enhance the body's tissue-building ability without causing harmful masculinizing effects.

Right now, the search is on for improved "nonmasculinizing" hormones (modified androgens) that would enable premature infants or ailing elders to build muscle and gain weight and vigor.

Searle's Nilevar, one of the 19-nor compounds, is being marketed as an anabolic agent. In just two years, this product has achieved an annual sales volume of close to $2 million, despite its relatively high prescription cost. An important superandrogen is fluoxymesterone—marketed by Upjohn as Halotestin, by Squibb as Ora-Testril and by Ciba as Ultraden. This anabolic is newer and less expensive than Nilevar.

Development of cancer therapy agents is high on the agenda of companies working in the steroids field (*see table p. 40*). While no decisive scientific breakthrough has yet been made, modified androgens are being used to suppress breast cancer, and certain estrogenic agents are being used to counter the growth of prostatic cancer. Effects of these drugs are mainly palliative and delaying.

Other fields that claim steroid hormone producers' research attention: cardiovascular diseases, hypertension, hemostatics, anesthetics, antibiotics and cosmetics. Activity in these areas is summarized in the table.

Changing Production Pattern

Sapogenins derived from Mexican dioscorea (barbasco root) predominate the steroids raw-material supply complex. But Mexican source materials share the limelight with other sterol and steroidal source materials —vegetable oils, beef brains, beef bile, spinal cords and fish oils.

It's virtually impossible to draw clear-cut lines between producers of steroid raw materials, intermediates and finished products. Many companies perform one or more of these roles. Complex interrelationships exist between raw-material suppliers and raw-material users, intermediate suppliers and intermediate users.

The flowsheet (*pp. 44-45*) sketches the key commercial routes followed by the leading steroid hormone producers. Note: many alternate approaches to various finished compounds are possible.

The following companies produce steroid hormone intermediates: Syntex, Protex (General Mills), PESA (G. D. Searle), Diosynth, Schering, Upjohn, Merck Sharp & Dohme, Canada Packers, Roussel, Pfizer, Julian Laboratories, Schering AG. and Chemetron.

Makers of finished products include Upjohn, Pfizer, Schering, Roussel, Organon, Syntex and Merck Sharp & Dohme.

Leading steroid hormone sales organizations supplying pharmaceutical dosage forms: Merck Sharp & Dohme, Upjohn, Schering, Pfizer, Ayerst, Ciba, Lederle, Squibb, Roussel, Organon, Schering AG., Farmitalia, Lepetit, Searle and Parke, Davis.

Key raw materials: diosgenin, hecogenin, stigmasterol, cholesterol, cholic acid and desoxycholic acid.

Cholesterol is extracted from beef brains, spinal cords and fish oils. Stigmasterol is derived from vegetable oils. These sterols are higher alcohols of cyclopentanophenanthrene, have a double bond between positions 5 and 6.

Steroidal sapogenins (e.g., diosgenin and hecogenin, from Mexican plants) differ from cholesterol and stigmasterol in that they have a spiroketal side chain at positions 16 and 17. Although all the sapogenins have a hydroxyl group at position 3, they may have additional hydroxyl groups at other positions; and in any case, the hydroxyl radicals are never free or found as simple esters. They exist as glycosides, making the sapog-

enins water soluble and highly saponaceous.

Bile acids, a third variation of natural sterols, have a hydroxyl group in the 3-position. Additional hydroxyls may attach elsewhere on their steroid nucleus: all have a characteristic side chain at the 17-position, which ends in a carboxylic group. When they're converted into alkaline salts, these compounds are highly soluble surface-active agents, properties they share with the sapogenins before these are hydrolyzed.

When Syntex showed that removal of the 19-methyl group enhances the hormonal activity of desoxycorticosterone, progesterone and a number of other hormones, there was a rise of interest in the possibility of manufacturing 19-nor superhormones (*see flowsheet pp. 44-45*).

Since no method of direct removal of the 19-methyl group is known, 19-nor compounds must be built from a steroid nucleus that lacks this angular methyl group. Estrone, a key sex hormone, provides such a nucleus.

Today, estrone is being synthesized from dehydroisoandroestrone obtained from cholesterol or from sapogenin degradation. Know-how for the tricky estrone synthesis is limited. Roussel (France) and Schering AG. (West Germany) are the only two companies in the world that might be called "old hands" at this procedure. Both firms prepare a large part of their starting material by oxidizing cholesterol, available to them at low cost as a by-product of fish oil vitamin production and wool grease production.

Roussel's and Schering AG.'s cholesterol oxidation gives higher yields than any achieved by U.S. companies to date. U.S. and Mexican steroid hormone manufacturers, however, are steadily improving their own estrone syntheses to meet increasing demands for 19-nor compounds.

Stigmasterol still garners attention as a steroid raw material in today's brisk market, even though Upjohn is the only company using it.

When Upjohn moved into corticosteroids, the company based its production on progesterone supplied from Mexico. But because management hesitated to put all of their eggs in a Mexican basket, a synthesis of progesterone from stigmasterol was developed. Today, Upjohn's production is based, in large measure, on stigmasterol obtained from crude soya sterols.

General Mills' vegetable oil plant at Kankakee, Ill., extracts sterols from soya bean oil for Upjohn. This cooperative effort of Upjohn and GM has paid off in increasing the world progesterone supply.

And it brought General Mills into the steroids raw-material supply picture. Two years ago, the company entrenched itself in this activity by buying Protex, one of the smaller Mexican sapogenin producers. Outlook: General Mills will probably swing considerably more weight in the steroids field because of its solid base.

What about bile acids as steroid source materials? Upjohn's fermentation process, which allowed the use of Mexican sapogenin raw materials in corticosteroid production succeeded in easing the pressure on the limited world supply of bile acids and desoxycholic acid. But Merck and Roussel still prefer the chemical approach from bile acids, rather than a fermentation process.

Working steadily to improve their bile acid processes, Merck and Roussel have successfully lowered their production costs by hiking yields and increasing production volume.

Schering continues to process some bile acids, buys most of its steroid intermediates from competitors that make these compounds both by fermentation and bile acid degradation.

While the "meti" steroids, prednisone and prednisolone, may be easily prepared from bile acids, fermentation offers excellent ways of introducing the important Δ^1 bond. But, because fermentation know-how is now concentrated in the hands of a few large producers (mainly Upjohn and Pfizer), many smaller firms have been turning to bile acids in an effort to get on the "meti" bandwagon.

Syntex and some smaller firms are buying cortisone, converting it into prednisone (by selenium dioxide oxidation). Syntex also makes prednisone from hecogenin extracted from Mexican sisal; Glaxo in England makes it from hecogenin derived from African sisal. Glaxo and Syntex are cross-licensed on their hecogenin processes.

Indications are that hecogenin will figure more prominently in steroid producers' production plans. PESA (now owned by G. D. Searle) has stated that it will also go into full-scale production of hecogenin.

Last year, Syntex revealed that it had synthesized cortisone from botogenin, a sapogenin of the Mexican plant *dioscorea spiculiflora*, first described by Russell Marker in 1947. Because recent work in the cortical hormone field indicates that substitution at carbon-6 increases biological activity, botogenin—which has a 5, 6 double bond—is more interesting than hecogenin. The firm sees botogenin as a starting material for various substituted corticosteroids.

Canada Packers Ltd. (Toronto) has developed its own techniques of producing a variety of steroid compounds from cholic, desoxycholic and other lesser-known acids derived from hog bile. This firm holds patents on the synthesis of progesterone from hyodesoxycholic acid and on improved techniques of degrading bile acid side chains.

The following is a summary list of the primary and secondary intermediates used by the industry today:

Primary intermediates from diosgenin—pregnenolone; Δ^{16}-pregnenolone; 16,17-epoxypregnenolone; Δ^{16}-pregnenolone oxime; dehydroepiandrosterone.

Primary intermediates from bile acids—cholic acid; desoxycholic acid.

Secondary intermediates — progesterone; Δ^{16}-progesterone; 16α-methyl pregnenolone; 16α-methyl progesterone; compound S; 16α-methyl compound S; 6-methyl-Δ^{16}-pregnenolone; 6-methyl, 17-hydroxy progesterone; pregnadiendione; 11-keto pregnanolone; 11-keto, Δ^{16}-pregnanolone; 11-keto, 16α-methyl pregnanolone.

Commercially important finished products made from these primary and secondary intermediates: cortisone; hydrocortisone; prednisone; prednisolone; triamcinolone; dexamethasone; 6-methyl prednisolone; 6-methyl-17-acetoxyprogesterone; testosterone; methyl testosterone; 4-chlorotestosterone; estrone; estradiol; 19-nor compounds; fluoxymestrone; and fludrocortisone.

The search for economic raw materials for steroid hormone production is far from ended. But the raw-material supply problem is no longer critical. With continual improvements being made in production processes, raw materials now go a lot further than they did in the early days of cortisone. Moreover, they can be used more or less interchangeably in different production schemes.

Production problems today are almost of secondary importance. The emphasis now is on the creation of steroid structures that can make inroads into new markets.

Each new compound resulting from this search changes the relative importance of the various starting materials. But, by and large, producers tend to stay with the know-how they've developed at great cost.

It's highly unlikely, for example, that Merck—with its efficient bile acid processing system—would shift to the seemingly more attractive fermentation process for utilizing sapogenin raw materials. This possibility, however, cannot be entirely ruled out, especially now with dexamethasone promising to top the sales records of any of the other corticosteroids. Because dexamethasone can be made most readily from hecogenin, a new producer might be strongly tempted to develop the necessary know-how for the hecogenin process.

Nor will dexamethasone be the last corticosteroid advance to influence the raw-materials balance. Companies with the most flexible processing schemes ultimately will fare the best.

The Raw Materials Search

In the precortisone days, sex hormones (e.g., progesterone, testosterone and estrone) were isolated from tons of sow ovaries, bull testes and equine urine. Later, they were synthesized from cholesterol.

Vigorous oxidation removes cholesterol's side chain, leaving a ketone at the 17-position. Conditions required for this amputation are so drastic that a ton of starting material ends up as 10-20 lbs. of intermediate after the first step alone.

Even when this synthesis was carried out on a large scale, the sex hormones could not be produced in the early days for less than $100/gm. and more. Yields have been improved at least threefold and as much as 10-fold, but the procedures are still tricky and wasteful. Today, the few companies who are expert at these syntheses employ highly specialized, secret techniques.

This explains why steroid hormone manufacturers sought cheaper raw materials that could foster higher yields. Plant sterols were the logical area for investigation. Sitosterol, an abundant sterol occurring in all vegetable oils, proved unsuitable because of the tenacity with which it clings to the side chain at position 17.

Stigmasterol, on the other hand, which occurs along with sitosterol in some vegetable oils (especially soya bean oil) has a built-in weakness—a double bond—between carbons 22 and 23. This weakness was recognized by researchers and exploited to permit ready conversion (in good yield) of stigmasterol to pregnenolone.

Stigmasterol unfortunately is not easy to isolate, and it's not inexpen-

30 NAMES

Ayerst Laboratories
Boots (England)
British Drug Houses (England)
Canada Packers
Ciba
Chemetron
Diosynth
Farmitalia (Italy)
General Mills
Glaxo (England)
Julian Laboratories
Lederle
Lepetit (Italy)
Merck Sharp & Dohme
Merck (West Germany)
Organon
Parke, Davis
PESA (G. D. Searle Chemical)
Pfizer
Protex S.A. (General Mills)
Roussel (France)
Schering AG. (Berlin)
Schering (U.S.)
Searle
Smith Kline & French
Squibb
Syntex
Upjohn
Vismara (Italy)
Warner-Lambert Research Institute

IN THE RESEARCH–PRODUCTION LINEUP

STARTING MATERIALS	END-PRODUCTS	MAJOR R&D INTEREST
equine urine	conjugated estrones	sex steroids; steroid hemostatics
progesterone	cortisone and derivatives	
	sex hormones	anabolics; progestins; steroid tranquilizers
beef bile; hog bile	bile acids; intermediates; sex hormones	
steroid intermediates	androgens	anabolic steroids; corticoids; aldosterone and antialdosterone
sex steroid intermediates	sex hormones and intermediates	improved sex steroids and intermediates
dioscorea (barbasco)	sex hormones; intermediates	sex steroids and intermediates
		anabolics; corticosteroids; anticancer agents
soya sterols	stigmasterol; β-sitosterol	
hecogenin	cortisone and derivatives	corticosteroids
dioscorea	sex hormones; intermediates	
	triamcinolone and related compounds	corticosteroids; anticancer agents
cortisone	prednisone and derivatives	
bile acids	dexamethasone; cortisone; hydrocortisone; prednisone; prednisolone; 9α-fluorohydrocortisone and derivatives	anti-inflammatory treatments; steroids with other biological activities
cortisone	prednisone and derivatives	
compound "S"	cortisone and derivatives	corticosteroids; sex hormones
	progestational agents; prednisone and derivatives	anti-inflammatory agents; hormones; anabolic agents
dioscorea (barbasco)	sex hormones; intermediates; compound "S"	sex steroids and intermediates
compound "S"	prednisolone; hydrocortisone and derivatives	corticosteroids; steroid anesthetics
dioscorea (barbasco)	sex hormones and intermediates	
bile acids; cholesterol	cortisone and derivatives; sex hormones and intermediates	corticosteroids; sex steroids
cholesterol	sex hormones and intermediates	corticosteroids; sex hormones
bile acids; dioscorea (barbasco)	cortisone and derivatives; sex hormones and intermediates; dexamethasone	corticosteroids; sex hormones; cardiovascular agents
sex steroid intermediates	19-nor compounds	anabolic agents; anticancer agents; antialdosterone; diuretics; anti-cortisone compounds; progestins; cardiovascular agents
		anabolics; anti-inflammatory agents; antialdosterones
	triamcinolone; sex hormones	anti-inflammatory agents; corticosteroids; sex hormones; allergy drugs; anticancer agents
dioscorea (barbasco); diosgenin and hecogenin	sex hormones; adrenocortical hormones; progestational agents; 19-nor compounds; anabolic agents and all steroid intermediates	progestational, anabolic, anticancer and anti-inflammatory agents; antihormones; compounds to increase feed utilization of animals; cardiovascular agents
stigmasterol	6-methyl prednisolone; cortisone and derivatives; progesterone	corticosteroids; anabolics; progestins; anticancer agents; long acting hormones
cholesterol	sex hormones	
		steroid tranquilizers; anticancer agents; proconception compounds

sive. And until Upjohn developed its microbiological process for oxygenating the steroid nucleus, stigmasterol could not be converted into cortisone by any known chemical technique.

While stigmasterol was suitable for the production of sex hormones, it still had to compete with cholesterol, a relatively low-cost and easy-to-obtain raw material.

Steroidal sapogenins found in the dioscorea plants of Mexico came into the commercial picture next, were relatively easy to isolate in pure form and convert into useful intermediates.

When cortisone broke into the drug market, chemical techniques of utilizing cholesterol, stigmasterol and diosgenin as raw materials did not exist. Steroid chemists turned instead to bile acids, the only available raw materials having a hydroxyl grouping at position 12. Moving the oxygen atom from position 12 to 11 was a tough job, chemically, but the only feasible way to commercially produce cortisone. To make matters worse, beef bile was a limited source of steroid material. Merck scoured abattoirs all over the world to find sufficient bile acids to meet its early requirements.

Drug companies, meanwhile, undertook large-scale programs to develop chemical techniques for introducing the oxygen function at the 11-position of pregnane compounds. The latter could be made from diosgenin, stigmasterol, cholesterol and ergosterol.

Expeditions went into the jungles of the world to hunt for botanical sources of sapogenins that might fortuitously have oxygen functions in the C ring, thus provide a built-in solution of the problem.

In Africa, botanists searched for a rare *Strophanthus* vine, which years before yielded a few grams of sarmentogenin, a steroid with oxygen at position 11. In Mexico, a species of dioscorea containing botogenin was singled out as a carrier of oxygen in the 12-position.

Researchers devised all sorts of chemical techniques of introducing oxygen into the 11-position of desoxy steroids, but these generally were involved and costly.

A commercially feasible solution of the raw-material supply problem was not found until Upjohn unveiled microbiological fermentation of the steroid nucleus. With one stroke, the raw-material supply picture changed, as did the outlook for large-scale, low-cost production of cortisone and derivatives.

Thereafter, all raw materials yielding desoxy pregnane compounds could be utilized to break the bottleneck posed by the limited supply of bile acids.

Upjohn started its cortisone synthesis with progesterone, available in virtually unlimited quantity from diosgenin.

Progesterone was fermented to yield 11α-hydroxy progesterone, which, in turn, was converted into cortisone. Upjohn and its competitors developed fermentation processes for making hydrocortisone and new cortisone analogs.

In many of these processes, compound S is the key intermediate synthesized. Compound S lacks the critical oxygen at position 11, but further fermentation converts it into epi-F, which yields cortisone on further oxidation. Processes have since been worked out that convert compound S directly into cortisone derivatives.

The newest corticosteroids (with further modifications at the 6, 9 and 16 positions) can also be made via fermentation from derivatives of progesterone and compound S.

Busy Foreign Scene

Overseas, the steroid treasure hunt is going full tilt. In England, Boots is in full-scale corticosteroid production under license from Upjohn. Glaxo, also in England, has a commercial process (cross-licensed from Syntex) for making corticosteroids from African sisal-derived hecogenin. This frees Glaxo from dependency on raw materials purchased in dollar areas.

In Holland, Organon's cortical hormone fermentation plant is operating; as an aftermath of this expansion, the company's bile acid process has apparently been abandoned. Organon now buys large quantities of compound S in the Western hemisphere, to supply its new fermentation operation; it also buys the compound from Schering AG., whose big new compound S plant is in operation.

Foremost in the steroids field in Italy is Farmitalia, which has tie-ins with Merck in the U.S. In Italy, as in other European countries, physicians were at first slow to adopt the steroid drugs, but this attitude is rapidly changing. Farmitalia is screening hundreds of new steroid compounds. Most of its production emphasis currently is on fermentation synthesis.

Lepetit is also marketing steroids in Italy. Linked with Schering in the U.S., the company puts particular emphasis on production and marketing of the "meti" steroids. Lepetit makes these from advanced intermediates furnished by U.S. companies. The talk now is that it will install its own complete facilities for making corticosteroids from compound S.

Another Italian firm, Vistar Laboratories (pharmaceutical division of Vismara, meat packer) sells steroid hormones made by oxidation of cholesterol. Recently installed: fermentation equipment for producing small quantities of almost all steroid hormones now in demand.

Steadily increasing European usage of newer steroid hormone drugs provides strong incentive for foreign manufacturers to step up their production activity, expand their research efforts. Not the least important factor spurring them on is the promise of mass markets in Asia. The governments of India and Japan are seriously considering the support of multimillion-dollar programs for promoting oral contraceptives as a means

Meet the Author

NORMAN APPLEZWEIG

AS HEAD OF THE consulting firm of Norman Applezweig Associates (New York), the author (M.S., biochemistry, '47—New York University) makes it his business to know what's happening behind the scenes in the lively steroid business. He has been consulting in steroid hormone research and development since July 1949.

Trained as an organic chemist, Applezweig did graduate work in cellular physiology and endocrinology. He was research director of a large meat packing firm, where he concentrated on steroid development and production. In his search for useful steroids, he has investigated such source materials as adrenal glands, bile acids, vegetable oils, paper pulp and steroid alkaloids.

CW PHOTO—JEAN RAEBURN

With Russell Marker, one of the pioneers of sapogenin research, Applezweig helped promote Mexican plants as cortisone source materials.

of slowing their phenomenal population growth rates.

U. S. producers can anticipate that steroid production will start in Asian and Latin American countries once demand starts its climb.

Still to be heard from on the question of steroid production are the U.S.S.R. and Red China. Reports issuing from behind the Iron Curtain indicate that these countries are far behind the U.S. in steroid research as well as production. But there is no evidence of a shortage of qualified researchers, who might fashion the major breakthroughs of tomorrow.

The Russians already have in circulation what probably amounts to the most up-to-date (1955) text on steroid chemistry, titled "The Chemistry of Steroid Hormones." It was written by Professors Nazarov and Bergelson, of the Institute of Organic Chemistry, and was published by the U.S.S.R. Academy of Sciences (Moscow). Most of the references are non-Russian, but this doesn't alter the fact that it's the latest complete text now available in the U.S. or in western Europe.

Harvard Professor Louis Fieser's text on steroid chemistry is expected out soon. It is awaited with a great deal of interest by the industry.

Product, Process Patents Galore

Largely as a result of the rapid pace of research during the past 10 years, the U.S. Patent Office now numbers more than 3,000 issued patents in its crowded files.

In the early days of the corticosteroids, patent backlogs were formidable. Since the Patent Office introduced an IBM automated system for sorting claims, the situation has eased. Still to be added to the new system: an automated way of searching the countless thousands of foreign patents and literature references to steroid technology.

Trouble arises these days not so much from the number of claims, patents and references but because steroid research competition has become so keen that most new applications run into interference with at least one, but more often with more than one, other patent applications.

Right now, for example, Schering, Syntex, Merck, Upjohn and Pfizer are locked in a five-way interference over the basic rights to prednisone, one of the industry's big-selling corticosteroid specialties.

Last November, Syntex's patent suit alleging infringement of U.S. 2,579,479 (which covers $\Delta^{1,4}$-compounds) by Merck and Schering was settled out of court. Both defendants have obtained paid-up licenses on all past, present and future $\Delta^{1,4}$-compounds they produce and market.

Even though Syntex won its case on the broad class of $\Delta^{1,4}$-compounds against Schering and Merck, it still faces a contest over rights to the specific $\Delta^{1,4}$-compound prednisone. Four other companies claim this compound.

Squibb holds a basic patent posi-

tion on 9α-fluoro compound. Upjohn is basic on the 6-methyl compounds and on key microbiological fermentation processes for producing 11-oxygenated compounds. Upjohn recently revealed that Pfizer is licensed to ferment steroids under Upjohn's basic patent (U.S. 2,735,800).

Merck and Schering may end up in a patent tussle over the rights to dexamethasone (16α-methyl derivative of 9-fluoroprednisolone), newest of the corticosteroids. Both companies' technical teams hit on the development independently and almost simultaneously. Dexamethasone incorporates advances made by Syntex ($\Delta^{1,4}$ compounds) and Squibb (9-fluoro compounds).

Merck and Schering were neck-and-neck, too, on their disclosure of the 16-β-methyl derivative of 9-fluoroprednisolone. But the key question of patent rights for this compound, again, is far from clear.

Upjohn and Syntex simultaneously claimed discovery of 6,9-difluoroprednisolone, in addition to an entire series of 6-fluorinated corticosteroids. The 6,9-difluoro compounds are reported to have 426 times the activity of hydrocortisone. And while neither company has yet said anything about the usefulness of the products in therapy (they may be too toxic), it's probable that these materials will serve as the basis for a new series of highly active corticosteroids.

Upjohn says that fluorine in the 6-position makes progesterone orally active, suggests that fluorinated progestins may prove useful. What will happen about patent rights on this score is anyone's guess.

Last July, Pfizer bought patents that originally were issued to Glidden, no longer active in the steroids field. Pfizer is reportedly planning action against infringers of these patents, particularly against importers of 16, 17-epoxypregnenolone.

In the noncortico steroid area, the following key compounds are covered by product patents: Searle's Enovid (U.S. 2,725,389); Searle's Nilevar (U.S. 2,721,871); Parke-Davis-Syntex's Norlutin (U.S. 2,806,030); Upjohn's Halotestin (U.S. 2,806,683).

Heading for the Top

In the next few years, the steroids industry will come of age. Steroid hormones with "optimum" properties will be developed, prescribed and distributed with much the same freedom as sulfa drugs, antibiotics and other well-entrenched ethicals. Once researchers have overcome the side-effects that still worry clinicians and producers, the drugs will become "standards" in the product lines of many more drug companies.

Steadily increasing dollar volume of steroid hormone sales will entice new producers into the field. Some of the larger pharmaceutical houses not now manufacturing or selling steroid hormones will develop their own variants of the newer compounds or purchase existing products in bulk from competitors. The key to success in launching new compounds will be, as it is now, thorough clinical research.

Competition among raw materials suppliers for new business will grow stronger; raw material supply should pose no problem to new producers. What may harry them, however, are patent interference problems. But even on this score, new entrants (and even existing manufacturers) can build up relative immunity. Reasons: many existing patents contain weak and contradictory claims; many patents are held by firms that are willing to cross-license others, share market rewards.

Steroid hormone therapy is just beginning to catch on abroad. Foreign firms are feeling rapidly increasing demand for these products and are gearing to meet the demand. The strongest market response has developed in Germany, Italy and Japan. U.S. steroid producers will probably compete best in the export market by tieing in with well-established foreign firms.

The market for the newer noncortico steroids will increase at a much greater rate than the corticosteroid market. Simple dosage forms of low-cost progestational agents will find acceptance as routine therapy in gynecological disorders. Improved progestational agents will be put to mass use as oral contraceptives. Steroid anabolics, veterinary drugs, hormone antagonists, cardiovascular agents and anticancer drugs will be further developed. In time, steroid hormone products will hit first place among the ethicals.

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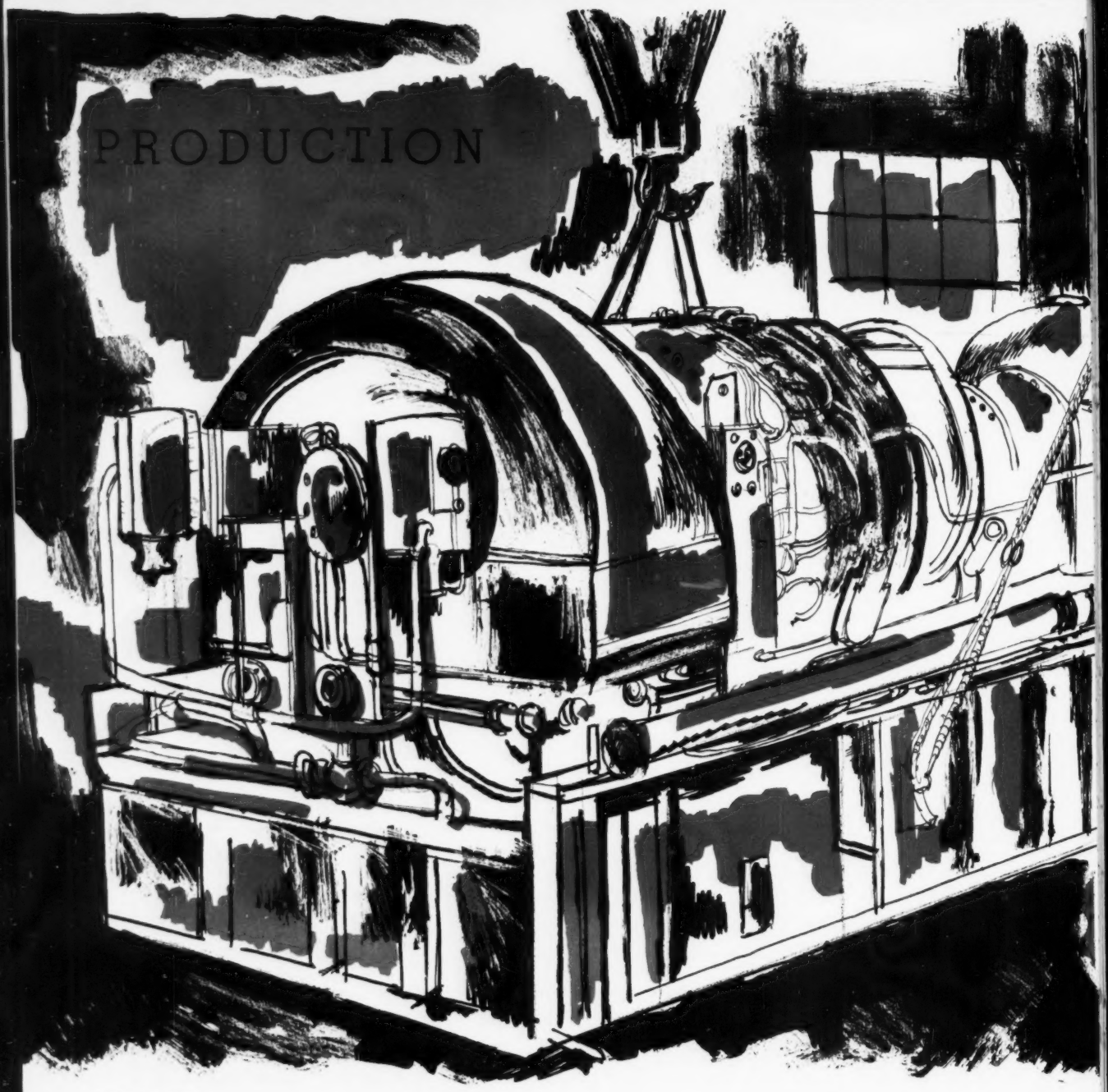


SKETCH BY R. KLUGA

Equipment Maker Touts Reliability to Boost

Chemical plant management received reassuring news from General Electric this week. Object: to dispel concern about the gas turbine's reliability in process industry heat and power jobs. GE, which claims first place for its gas turbines both in number of units and in total operating hours, reports that its basic problems affecting reliability have been solved.

Over the past few years, gas turbines have received much favorable attention in technical publications. And their low cost and reliability have won many petroleum, and some chemical, jobs. But recent trouble-spots have caused some potential gas turbine users to adapt a wait-and-see policy. Most publicized difficulties: startup delays of Esso's ethylene plants for supplying polyethylene and ethylene-oxide makers (*CW, June 28, '58, p. 74*).

Unofficially, most trouble has been "blade cracking." Officially, little information has been available until now.

In an interview with *CW* this week, Jack Mangan, manager of industry sales for GE's gas turbine department, pinpointed his firm's gas turbine troubles this way:

"The recent problems we've had stem from scale-up to larger sizes. We went through the others—proving the reliability of basic design, use of various fuels—five or more years ago. And our 7,000-8,000-hp. gas tur-

CW PHOTOS—LIONEL CRAN-GOH

GE's Morgan: 'Recent problems stem from scale-up to larger sizes. We now have reliability in all turbine sizes.'

Stock of Big Turbines

bines have been performing satisfactorily. When we scaled up to the 12,000-20,000-hp. models we ran into some of the difficulties that gained recent attention—the problems we've had to solve over the past year. We now have all the reliability in large turbines that a customer should expect."

And GE seems to have made a good start. The 13,000-hp. gas turbines involved in an ethylene plant fire last fall at Esso's Baton Rouge refinery (*CW, Oct. 18, '58, p. 23*) continued running until shutdown some minutes after the fire began, yet sustained no rotational damage. The only damage was structural, caused by collapse of the building and exterior ductwork. Esso blamed the fire on a centrifugal compressor — a unit whose reliability is seldom questioned.

Buckets, Shrouds and Wheels: One of the puzzles encountered in the scale-up arose when longer blades (GE calls them buckets), with minor variations in their manufacture, caused vibration, resulting in bucket fatigue.

The problems were entirely different from those of a steam turbine scale-up. Steam turbine blades have a different shape. They are shrouded, grouped so that effects of variations are spread out over the group. The gas turbine blades couldn't be grouped, since shrouds riveted to the blades would not stay on at the gas turbine's higher operating temperatures. Solution: a tie-pin between blades; but location of the pins to minimize drag and reduce horsepower losses created another problem.

GE also had trouble with metals when the size of the turbine wheels were increased. It took about six months to develop forging techniques, prevent segregation of the chrome alloy during melting, get wheels that wouldn't crack.

No Corner on Questions: But GE isn't the only gas turbine maker that has faced problems. "We've had our share of them, including blade cracks," says Tom Putz, manager of Westinghouse's industrial gas turbine department. "But steam turbine blades crack sometimes, too," he adds, "and steam turbines have been around a lot longer than gas turbines."

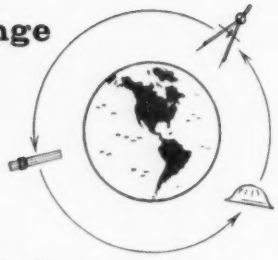
Putz also points out that different gas turbine designs have encountered different problems. But because the gas turbine is still relatively new, some people associate each problem with all designs, he says. Examples of design differences that may give rise to a variety of problems:

GE's turbines have two expansion stages; Westinghouse's have five. Consequently, GE's have larger parts, but Westinghouse's have more parts. And although GE turbines have a higher firing temperature (1450-1500 F—about 100 or more degrees higher than Westinghouse's), there is a greater temperature drop in each stage, and maximum blade temperatures are lower.

Clark reportedly has had operating difficulties, too. But, unlike GE and Westinghouse, it has not gone to gas turbines larger than 9,300 hp., and this may have helped it avoid some problems.

Brown Boveri, which installed its

the challenge



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first gas turbine in a now-obsolete Houdry cracking unit in 1936, hasn't been faced with major problems in the chemical industry. The prewar turbine was small—about 1,200 hp.; and since the war, Brown Boveri has been concentrating on expanders used in conjunction with isotherm compressors for chemical plants (mainly nitric acid) in this country. (The usual gas turbine package is an axial compressor, combustion chamber and expander.) And the expander's operating temperatures are considerably lower—only about 900 F—than those of GE and Westinghouse turbines.

Catching On: Despite these development pains, the gas turbine is catching on as a reliable heat and power source. For example, GE reports gas turbine runs of two years without maintenance and runs of 18 months without a shutdown.

GE feels that gas turbine maintenance is little more trouble than steam turbine plant maintenance. After the first 8,000-8,700 hours (one year's operation), the turbine should be shut down for inspection; after the first-year inspection, a three-year maintenance cycle should be possible. "When the process is shut down, you should, of course, look at the turbine—as you would check any other equipment," says Mangan.

And, when using liquid fuels rather than gases, operating times must be cut—say, 200-400 hours burning residual fuel (e.g., bunker C), 400-800 hours using diesel fuel—unless special operating methods are adopted.

The major drawbacks to gas turbines seem to be in higher installation and operating costs for the small plant. (For example, investment cost, while comparable to steam turbine or engine plant, might be one and a half to five times that of an electric motor; maintenance cost from one and a quarter to 10 times as much as motor maintenance.)

But the gas turbine has important advantages to help tip the scales in its favor. Even in low-cost electrical energy areas, the gas turbine compares favorably. Power costs for electric motors are generally one and a fifth to eight times higher than for gas turbines. And gas turbines are started quickly, inexpensively. Power costs are high for starting electric motors; and synchronous motors require starting motors.

The load mass of a gas turbine tends to smooth out process surges. And, in the event of a process upset causing surge conditions, gas turbines could remain in operation, whereas electric motors probably wouldn't withstand the load, have to be cut out.

Turbines also have a variable speed advantage over electric motors. A single-shaft turbine's speed may be varied from 75-80% to 105-110% of rated speed. A two-shaft turbine has a wider speed range, although it costs about 10-15% more, usually isn't needed (e.g., if the turbine is driving a centrifugal compressor, the compressor design is usually the limiting factor).

Education Needed: Westinghouse Sales Manager Charles Burke feels that the gas turbine's reliability has been proved, that education is the next big job.

"Most industry people have tried to apply a gas turbine to a process as they would any other type of prime mover," he says. "But you can't just substitute a gas turbine for, say, an electric motor, and get a valid economic comparison. Where other prime movers put out only shaft power—give you horsepower and kilowatts—the gas turbine supplies compressed air, hot gases and, indirectly, process steam."

"The gas turbine must be integrated into the process," Burke adds. "You have to begin designing with a gas turbine in mind. In effect, a gas turbine is a compressor for compressing air or process gases at the start of a process and an expander (at the turbine end) for expanding gases and recovering process heat at the end of the process. In many applications, shaft power is only incidental to the other considerations."

Some processes have already been designed on this basis—actually use the gas turbine only as a heat source.

GE's Mangan considers this basic design approach as ideal. But he adds that gas turbines can be justified now from consideration only as a prime mover—provided the available exhaust heat is used, not thrown off. And Putz agrees that initial inroads made by the gas turbine will be chiefly as a prime mover but that ultimately emphasis will shift to its application as a heat source in basic process designs.

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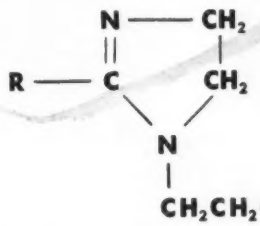

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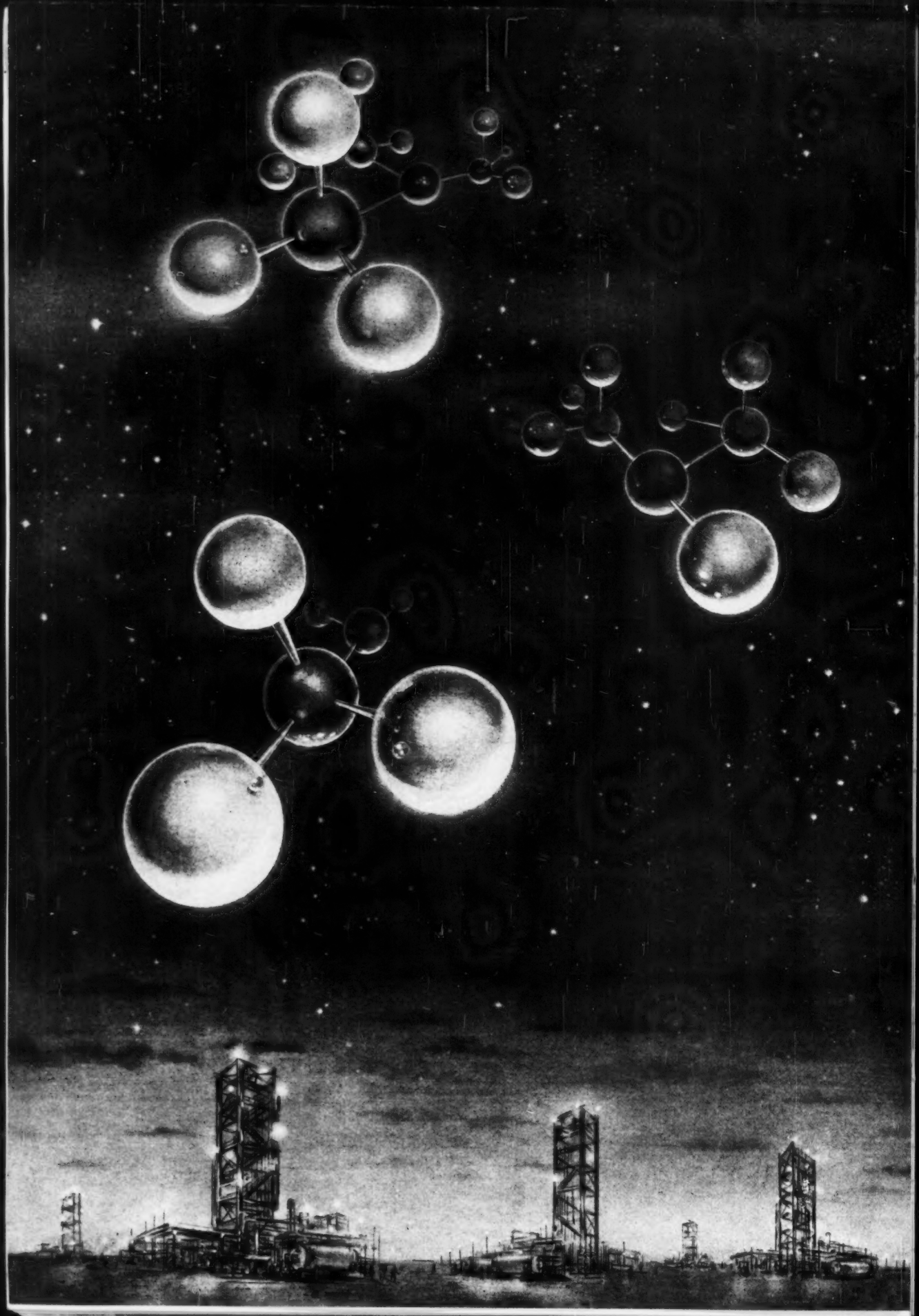

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Technology
Newsletter

CHEMICAL WEEK
January 31, 1959

A new way to make plate glass without grinding and polishing was disclosed last week by the British firm of Pilkington Brothers, Ltd. Known as the "float" process, it involves floating a continuous ribbon of glass on the surface of molten metal under rigidly controlled atmosphere. The combined effects of weight and surface tension cause the ribbon to assume "absolutely uniform thickness," claims Pilkington, with "exceptionally parallel, distortion-free surfaces." Processing advantages: output is not limited or controlled by viscosity of the glass; process is continuous throughout, therefore can be completely automated for operating economy.

•

Chemicals may cut the $500,000 weed-control price tag paid by celery growers each year. New tests, reported by C. A. Shadbolt, assistant olericulturist at the University of California (Riverside), reveal that neburon and chloro-IPC have effectively repressed weeds, eliminated hand labor in two-year tests on celery grown from transplants. Neburon is a urea herbicide sold by Du Pont as Kloben (*CW, Jan. 17, p. 95*). Chloro-IPC is offered by several companies—it is isopropyl-N-(3-chlorophenyl) carbamate. Neither chemical has been registered for commercial use on celery.

•

Vacuum-deposited cadmium is just the thing to protect high-tensile steel from corrosion. That's what National Research Corp. is saying this week. Its reasoning: Normally, high-tensile steel is electroplated. But the acid plating bath gives up hydrogen to the steel, causing it to become embrittled. Deposition by vacuum techniques eliminates any exposure to hydrogen at all.

National Research sees immediate application in aircraft, for elements exposed to stress (landing gear structures, control components, etc.). It hopes the material will eventually catch on in automotive products, industrial machinery and other large-volume outlets.

•

Ingredients of Dri-Die Insecticide 67 are revealed as silica gel and ammonium fluosilicate in an application to the U.S. Dept. of Agriculture for permanent registration of the product. Applicant W. R. Grace & Co. (Davison Chemical Division) (*CW, Oct. 25, '58, p. 92*) did not previously reveal the presence of the synergistically active fluosilicate for patent reasons. If the application is granted, Davison will market the hitherto-experimental insecticide.

•

A synthetic that may boost natural rubber marketing? (*See also p. 21.*) B. F. Goodrich (Akron, O.) is out with a new material, brominated butyl (Hycar 2202), that reportedly imparts superior ozone-resistance and air-holding properties to tree rubber. Goodrich believes the newcomer will permit the manufacture of tubeless tires from natural rubber.

Hycar 2202 is also claimed to vulcanize faster than butyl rubber; and it can serve as a base for an adhesive that bonds butyl rubber to metals and other rubbers. Development work on Hycar 2202 started in 1948 but the rubber has not yet found large-scale use.

•

Ytrium, ductile enough for structural applications in nuclear reactors, has been developed by Bureau of Mines at its Albany, Ore., labs. Key: lowering the dissolved-oxygen level to 200 ppm. Ytrium's assets include a low-thermonuclear cross-section and a melting point of 2825 F.

•

Paper pulp from Hawaiian bagasse is closer to commercialization this week as Crown Zellerbach starts up a new pilot plant at Camas, Wash. The plant will process up to 1,000 lbs. of raw material in a single batch. Main object of the experimental unit: to prove out the economics of the process. CZ says bagasse pulping has already been proved technically feasible in smaller-scale work. If test runs show the processing can be done economically, next step will be to build a pulp mill in Hawaii. The studies are part of a seven-year joint effort by CZ and Hawaiian Sugar Planters Assn.

•

How to get more oil out of tar sands and shale? Oil men are split this week over ways to do the job.

Richfield Oil starts talks with the Canadian government this week on the use of nuclear energy to recover petroleum from the tar sands at Lake Athabaska in Alberta. Richfield, which leases about 2 million acres at Athabasca, says any further statements on the parley must come from the Canadian Dept. of Mines and Technical Surveys (Ottawa).

And Sohio Petroleum Co. (Standard Oil of Ohio affiliate) may delay its program to recover oil from bitumen-containing sands at Asphalt Ridge, 15 miles west of Vernal, Utah. While the sands appear commercially suitable as a source of crude, there isn't enough nearby refining capacity to handle the large amounts of crude necessary to justify a recovery plant. Sohio is believed to be considering a mining and plant investment in the range of $25 million.

Item: Under agreements with Utah's Orem Development Co., Sohio must proceed with some type of production program in the next few years or surrender its leases on tar sand property.

•

Hexetidine, Warner Lambert's potent new topical germicide (*CW Technology Newsletter, Oct. 25, '58*), is now being eyed as a potentially valuable bacteria and fungi fighter for internal use, too. This new career may stem from recent discovery that hexetidine may be solubilized, using Atlas Powder's Tween 80, and may then be taken orally. Given orally to mice injected with the standard test fungus *Candida albicans,* hexetidine has shown a high rate of cure.

Newest packaging idea in a $13,800,000 market

Today, a new package can become the major selling point for a product if it makes the product easier to use. After revolutionizing sales for hair fixatives, colognes, insecticides and a host of other products, aerosols are the newest packaging idea to sweep into the $13,800,000 furniture-polish market.

The reasons for this success are simple. Aerosols deliver the product in a completely new form—a form that's easier, more effective and often more economical to use. If your product can be brushed, poured or sprayed, you stand a good chance to add new sales appeal—create vast, new markets—if you package it in an aerosol.

It is not necessary to set up your own packaging line to enter this field. A custom filler near you has the knowledge and equipment to help. He can package your formulation for testing and help you in all phases—from planning through production.

If you don't know the name of a custom filler, write Du Pont. We'll send you a list and include survey data on your market for aerosol products, plus information about Freon* propellents for aerosols. "Freon" is preferred by custom fillers and is used in more of today's aerosols than any other propellent. Write: E. I. du Pont de Nemours & Co. (Inc.), "Freon" Products Division 331, Wilmington 98, Delaware.

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J&L lined containers were selected by Amchem Products, Inc., Ambler, Pa. (formerly American Chemical Paint Co.) on the basis of rigid tests to determine maximum protection against contamination, deterioration and shipping damage.

"J&L lined containers prevent costly nozzle clogging"

... reports manufacturer of famous WEEDONE weed killer products

Spray-free operation is assured for Weedone products because uniform, clear phenolic linings in these J&L containers prevent nozzle clogging of weed-killer spraying equipment, state officials of Amchem Products, Inc., Ambler, Pa. If containers were not perfectly lined, insoluble metal salt particles could form from chemical reaction after lengthy storage.

Protection from contamination, deterioration and shipping damage is assured because of the high chemical resistance and stability of these J&L interior linings.

Prompt delivery and reduced shipping costs are achieved because J&L has a container plant near Amchem's Weedone production facilities.

Take a tip from the successful experience of Amchem with J&L containers. Nine strategically located J&L drum and pail plants assure you prompt, dependable delivery when you need it.

The J&L lining expert is always available to help you solve your most aggravating problems, *in confidence, of course.* For a confidential consultation with this expert, call your nearby J&L Container representative, or write direct to Jones & Laughlin Container Division, 405 Lexington Avenue, New York, N.Y.

Without baked, clear phenolic J&L linings, insoluble metal salt particles could gradually accumulate and cause trouble with clogging of spray nozzles in these WEEDONE steel containers. This filling operation is at Amchem's St. Joseph, Mo., plant.

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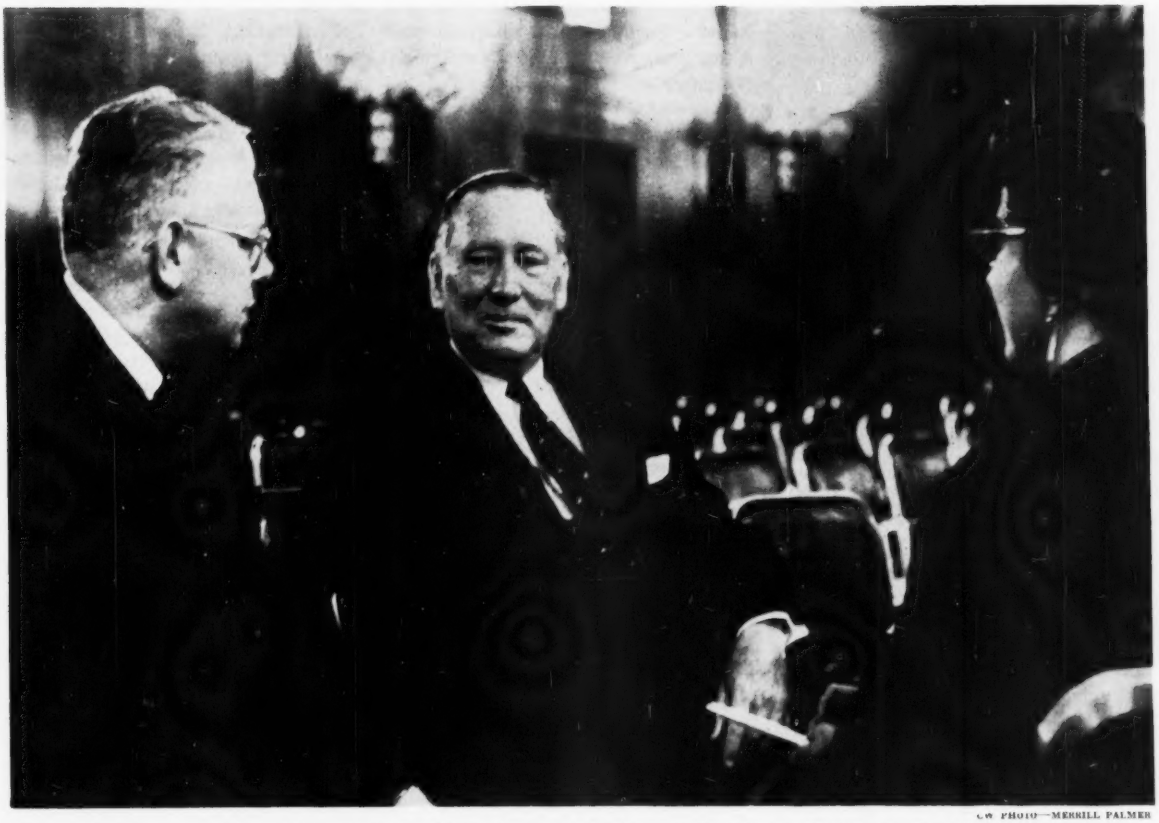


CW PHOTO—MERRILL PALMER

At purchasing meeting, CW reporter interviews Lederle's A. T. Ericson (left), Du Pont's H. H. Ewing.

Purchasing Men Spot '59 Buying Shifts

Interviews of chemical purchasing agents last week at their annual meeting* in Chicago and at home-office locations across the country highlight a varied outlook. Buyers are forecasting: no change in raw-materials inventories, a sharper look at imported materials and decidedly more pressure on suppliers to furnish ideas for improving packaging and materials-handling.

Moreover, there's a trend to automating purchasing paperwork and a move toward integrated materials management.

Buffeted by the recession storm, buyers made cuts—mostly a modest 5-10%—in raw-materials inventories last year. In '59, most buyers see no real change in their raw-materials position; many that did pare '58 stocks are not planning a return to '57 levels.

*Occasion: annual midwinter conference of the Chemical Buyers' Group of the National Assn. of Purchasing Agents.

Looking ahead several years, some buyers see automation leading to better inventory records, new opportunities for reduction.

Piping, parts and equipment inventories are another matter. *CW* found strong evidence that '58 cutback programs will be continued and extended wherever possible. Petroleum companies, for example, are stressing salvage, "in transit" shipments from suppliers, and vendor warehousing. One firm reports it has adopted a statistical method of determining equipment life and optimum reorder time.

But it's doubtful that inventory cutbacks can go very far. Main reason: prospects of a steel strike. Many buyers doubtless will increase stocks if a strike becomes a strong probability. And most purchasers are keenly cognizant of drawbacks in "overreduction"—possible loss in production time—when parts are not at hand.

Little change is apparent in contract vs. spot buying. Buyers will stay with contracts for big-volume "bread and butter" items, tend toward spot buying for materials that fluctuate widely in price or availability. On the West Coast, however, improved bulk chemical storage is paring the need for contracts. And there are isolated instances of medium-size chemical specialty firms abandoning contract buying because of contract cancellations and tougher price attitudes by big suppliers.

Turning Abroad? Reviewing world chemical markets at the Chicago meeting, Food Machinery and Chemical's assistant manager of international chemicals development, Fritz von Bergen, stressed the advantages of using more imported materials and of increasing overseas investments.

How do purchasing agents feel

about imports? For most, it's simply a question of economics. If a buyer can make a good deal he will; the vast majority said they use imports and none reported "no import" policies.

In the East, chemical purchasing men show little sign of upping imports; many expect '59 imports will about equal '58 levels. But in the Midwest, buyers are eyeing the Seaway, are projecting moderate increases in use of foreign materials. Chemical traders (with an obvious self-interest) also tell *CW* that buyers are becoming more sympathetic to foreign chemicals. Drug firms, especially, are leaning toward wider use of imported materials.

Some items—e.g., botanicals and metal ores—are available only from foreign sources. But, in cases where a buyer has a domestic-vs.-foreign choice, the big reason for buying abroad is lower price.

Price advantages, however, must outweigh some liabilities of using imports before most buyers will look to foreign shores. Chief problems:

(1) Longer delivery time.

(2) Delays in custom clearance and squabbles over duty classifications.

(3) Need to maintain larger inventories to counteract unexpected delivery delays and shipment rejections arising from off-quality.

(4) Frequent need to purchase in bulk to get maximum freight advantages.

(5) Currency exchange problems, if materials are purchased directly from producer.

Despite these obstacles, however, buyers report that delivery dependability has improved noticeably in recent years. And product quality, they add, has now improved to the point where it usually isn't a serious problem.

Domestic trade relations figure prominently in decisions to buy foreign goods; most purchasing men make efforts to minimize objections from their company's customers and suppliers.

Several *CW* respondents try to promote purchases from overseas trading areas of their company. Pharmaceutical firms—which often export 20-40% of their output—are especially mindful of international trade.

Coaxing Better Value: Program panelists and speakers at the Chicago meeting drew marked audience interest in exploring ways to increase value obtained from suppliers. Chemstrand's engineering superintendent, Alfred Bogen, stressed economic evaluation of raw materials, cited a case where purchasing probing showed that an item selling at 61.8¢/lb. had a total manufacturing and overhead cost of 26.8¢/lb.

And Diamond Alkali's general purchasing agent, C. D. Jones, pointed to big savings stemming from supplier thinking. A switch to barge shipment, f.o.b., from rail, delivered-price basis, led to a $500,000 economy. And a switch from rail to truck for coal delivery produced impressive savings on plant handling costs, and inventories.

Chemical buyers canvassed in *CW*'s survey are swiftly moving in the direction noted by the speakers at Chicago.

One Midwestern buyer sums up his worries this way, "the big need today is something between a bag and a drum. There just isn't enough variety in current unit containers. Present units lack a disposal system and must be shipped back. Complicating the problem of intermediate-size packaging, adds another PA: "the steadily rising price differential between bulk and l.c.l. prices—now often as much as 5¢/lb." And many a buyer is vexed by a lack of CPI standardization of multiwall bag sizes.

Because of such developments, buyers are especially in need of methods that permit bulk purchasing and handling. More are looking at compartmentalized-car shipments (at bulk prices) and at possibility of pooling shipments with neighboring companies. In the latter case, for example, a car load is purchased, then split at the destination among several users.

More Value Analysis: Almost all buyers report increased attention to scientific purchasing—the marshaling of all relative information to arrive at the optimum-advantage purchasing decision. In the Chicago area, one company will soon launch a "Purchasing for Profits" program, replete with meetings, instruction and required-reading material. On the West Coast, an oil processor will encourage regional warehousing by suppliers.

Another firm has come up with a method of evaluating value analysis. It hinges on such factors as the inventory involved, repetition of the saving and resistance met in effecting the change.

Performance measurements and purchasing control were urged by management consultant Richard Taylor (McKinsey & Co.). Singled out: determination of target prices, control charts with "rejection" specifications for suggested purchases, records of vendor delivery and special service performance.

Better liaison with suppliers to learn of new research and development work also ranks high in '59 plans of chemical buyers. Many are planning special joint meetings with suppliers to improve communications.

Yet, the path isn't completely smooth. Buyers say there are still too many instances of suppliers' reluctance to exchange confidences. Purchasing men voice especial annoyance at sales departments' reluctance to disclose availability of cheaper, substandard-quality grades.

That's one reason why increasing numbers of purchasing agents are looking at quality specifications. Significantly, superquality grades are also under scrutiny; in some cases, they can raise yields or smooth processing, result in over-all economies or a better-selling end-product.

Next Five Years: Automation, say buyers, clearly ranks as the major development in chemical purchasing within the next five years. Already installed in a few companies, and under study in many others, it holds promise of speeding paperwork, reducing errors, pinpointing problem areas and buying performance and of improving production scheduling and inventory levels.

Mechanization, however, will require careful planning. One well-known chemical buyer cautions, "It can progress to point of repetition. You have to build in flexibility or get locked up in the system."

The concept of integrated materials management may also gain.

Purchasing departments, *CW*'s survey showed, made numerous impressive savings in '58, hope to realize many more this year as the drive for efficiency continues. But buyers realize that value analysis and automation won't solve all their problems. And for the years ahead, the biggest management problem of all may lie in keeping purchasing staffers alert to the mounting wave of new developments.

Poly Bagging Gains

Two new developments in bags for chemical products were introduced last week—and polyethylene figures in both. One is a polyethylene sealer for paper multiwalls; the other, a new way to seal all-polyethylene shipping sacks.

Hudson Pulp & Paper is launching a new bag sealer that closes open-end shipping sacks with a polyethylene coated-kraft paper tape. Hudson claims it will make flat-tube (open-end) multiwall bags practical for shipping hydroscopic products such as caustic soda, nylon, ammonium nitrate and triple superphosphate. Moreover, it should increase the practicality of aluminum-foil multiwalls.

Hudson's unit, the Moisture Vapor Transmission Sealer, caps a 2.5-in.-wide tape over the open end of flat-tubes with the use of heat and pressure. The molten polyethylene flows into stitching perforations to make a tight, moisture-resistant seal. Older polyethylene-paper tape sealers "bridge" the stitching without sealing stitching holes. Conventional seals are more prone to transmit moisture if the tape is imperfectly applied or abraided in transit.

The sealer, believes Hudson, will offer several major advantages:

- A 30% decrease in moisture vapor transmission over wax-dipped flat tubes.
- Improved tensile strength at the seal.
- Production filling line at regular line speeds of 32-48 ft./min. (Wax dipping, another method of sealing, requires separate filling location because of safety hazards, is not very amenable to machine processing.)

Hudson expects that the claimed benefits will add up to substantial cost savings for many packagers. That's because wax dipping of filled multiwalls in a plant costs upwards of $16-$20/1,000 bags. Depending upon quantities processed, the tape sealer will process filled bags at costs comparable to tape applied to empty flat-tubes at the bag maker's plant: $3 per 1,000 bags (5-mil polyethylene tape coat on sizes up to an 18-in. width). Prices for thinner-gauge resin-coated tape range downward to $1 per 1,000 bags for 1.5-mil resin tape.

Lease or Buy: Initial plans call for leasing of the machine at $2,000/year; outright sale at an estimated price of $4,000. Separate, continuous-operation and intermittent-operation models will be offered. Hudson also expects to license the unit to other bag producers. Figuring a two-year write-off, the company calculates that nonbag users would need a 1-million-lbs./-year production quantity to make the machine pay. Present users of multiwalls would require a minimum output of 2-3 million lbs./year.

Indications are that the bag will soon be in use for caustic soda and a wide range of fertilizer materials. Tests on shipping sodium orthosilicate, polyvinyl acetate, nylon, sodium silicate and several other products have been encouraging.

Optimistic as Hudson is, however, it will face one or two obstacles. At the moment, the device offers only limited advantages with the widely used gusset-type bags, because no seal is provided over the gusset. Hence, use will be confined largely to flat-tubes. And there's every indication that the sealer may have to buck new competition from improved polyethylene shipping sacks.

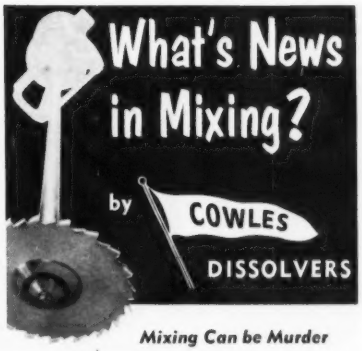
All-Poly Bag: The other new development, by Monsanto, is a polyethylene bag with built-in self-closing valve. The device will eliminate the biggest problem in using 10-mil PE sacks: heat-sealing filled bags.

First reported last spring (*CW, May 31, '58, p. 73*), poly bags quickly encountered surface contamination problems. In some cases, it prevented satisfactory heat sealing. The new bag side-steps this problem. The top is heat-closed before filling, leaving only the valve open. Pellets or particles in the valve can be readily dislodged by shaking.

The valve may markedly broaden polyethylene sack potential, now conservatively pegged at 75 million units (all types), of which 50% could be the valve types. The earlier, straight open-end bag was not suitable for loading with equipment designed for valve filling.

Polyethylene valve bag machinery isn't yet commercially available. But two firms—Chippewa Plastics (Chippewa Falls, Wis.) and Polyethylene Packaging Machinery Co. (Unionville, Conn.)—are now readying equipment for the marketplace.

The PE sacks are already in use for ammonium nitrate and PE resins.



Mixing Can be Murder

. . . but here are authentic cases of murderous mixing problems solved by the Cowles Dissolver—through greater volume rates and higher quality, in less space—involving even the most villainous materials.

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Aluminum Carbonate Dry Milling

End product reduced from 600 microns to 25 microns at rate of 1000-2000 lbs. per hr. That's with the Cowles alone—no milling. The Cowles does the job in many cases where milling was previously necessary.

Ester Gum Adhesives

500 gals. per hr. is the rate of production for a product containing 40% solids of ester gum. What's more, the end product is quite stable with particle sizes of less than 4 microns.

Filter Media Dispersions

Users report greatly increased efficiency of filtering equipment and product per man hour through use of the Cowles in preparation of filter media. Dispersions of diatomaceous earth, asbestos, cellulosic materials and combinations are being made for the improvement of pressure and vacuum filters which require excellent filter coating for optimum results.

Asphalt Suspensions

End product with a fineness of 99% through a 325 mesh screen is produced as a water barrier sheet in the manufacture of side boards of gypsum construction panels. It's just a single operation for the Cowles.

One Time Carbon Paper Formulas

Formulas including pre-wet iron blue press cake of approximately 35% mineral and 65% pigment are now being made faster and better. Reason is that the Cowles does a quicker, more thorough job of breaking down the cake into the balance of the formula used as application binder.

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CW PHOTO—LIONEL CRAWFORD

Monsanto's Van Wazer, Colgate's Wearn listen as soapmakers tell how they're meeting challenges.

Soapmakers Ponder Call for New Products

The 1,500 soapmakers at the 32nd annual convention of the Assn. of American Soap and Glycerine Producers in New York last week heard a heap of ideas for new products. Source: representatives of various industrial fields—e.g., textile, home appliance—who gave them some clear specifications for much-needed improvements in cleaning specialties.

There were also a few suggestions on currently available items. James Alaback, of Whirlpool Corp., producer of washing machines, said that any maker of detergents that hasn't a heavy-duty liquid product is missing a bet. The liquids, he said, have a big future with automatic washers because attempts at automatically dispensing granular materials have not been successful—and likely won't be in the future.

He also pressed soapers to come up with something new in the marketing of other laundry products—starches, bleaches, blueings, etc. He urged them to offer a packaged kit of these various additives so they will be added to washing machines in the proper proportion. He thought that such a kit would also be useful for automatic dishwasher use; it could contain, besides the detergent, packages of water softening agents, sanitizing ingredients and the like.

An area which Alaback thought lacking in good new ideas was the field of products for floor maintenance. He said floor maintenance is still performed in primitive fashion—that there is need for an economical machine to wash, scrub, dry and wax hard-surface floors in one continuous operation. Also, he thinks there's a need for a single machine to shampoo, beat and dry carpets.

Textile Trends: The changing textile field has created a demand for new products, say H. C. Borghetty and G. M. Gantz of General Aniline. They urge soap and detergent makers to come up with a host of new items. Among them:

- Formulas with improved soil suspending properties for Dacron-cotton blends.
- Better brighteners for wash-and-wear cotton.
- Detergent formulations with better emulsifying action for scrubbing synthetic fiber textiles stained with oil and grease.
- Longer-lasting static electricity reducers for synthetic fibers—preferably types that can be added to laundry rinses.
- Economical fluorocarbon resins which could be used to treat washable cotton, rayon, and synthetics.

Shop Talk: There are new trends in industrial cleaning, according to Albert Burner of New York's Port Authority and J. Lloyd Barron of National Biscuit Co. There's increasing use of "dry" or "semi-dry" cleaning techniques instead of the old "scrub and rinse" concept. They also predict an expanded use of "sanitizers" or germicidal cleaners.

Burner asked the industry to study the possibility of developing safer, more efficient specialized degreasing agents. The latter could mean big business to some suppliers, according to Burner. He points out that the Port Authority is paying $25,000/year for a cleaning compound used solely for removing grease deposits from airport runway ramps.

Fats and Oil: At the association's Fatty Acid Division meeting there was also a very marked interest in the future. R. B. Willemin of Merrill

Lynch, Pierce, Fenner and Smith gave his estimate—based on correspondence with world suppliers—of the '59 outlook for animal fats and coconut oil. He predicts that the various nations of the world will go outside their borders for 1.53 billion lbs. of tallow and grease in '59—slightly more than in '58. Of these requirements, he says, 380 million lbs. will come from exporting nations other than the U.S. The 1.15 billion lbs. exported from the U.S. will top the '58 mark by 60 million lbs. On the domestic scene, he sees an increase of 150 million lbs. in U.S. production of tallow and grease. He thinks that 30 million lbs. less will go into consumption in soap but feels that this will be offset by greater consumption in miscellaneous industrial products.

Lady and the Rug

Specialty makers who turn out products for do-it-yourselfers and/or professional rug cleaners can get some valuable market information from a survey just completed by the National Institute of Rug Cleaning. Depth interviews of over 200 rug owners turned up some tips on how to sell to both markets.

Do-it-yourselfers—Anyone selling a product for home use has these beliefs working for him: The housewife thinks the professionals shrink her rug, wet it too much (causing limpness) and use too-harsh materials. Also she sees them as experts who she feels challenge her competence. If she does call the professional cleaner she'd like him to do the work in her home—where she retains control over the process. The husband seldom influences rug cleaning; but when he does, he's an avid enemy of do-it-yourself products.

Send-Outers—For some women, getting the rug out for its first cleaning is apparently somewhat like giving junior his first haircut. With rugs, the first cleaning means the end of a rug's "newness." Cost doesn't seem much of a factor; few women seem to know what rug cleaning should cost, but they all think the price—whatever it is—is too high. Word-of-mouth advertising is the top influence in a woman's decision on which rug cleaner to use. Newspapers rank next, then television, followed by the Yellow Pages.

PRODUCTS

Steel Marker: Penapaint, a new marking material that can be used on bare metal to identify iron and steel sections, is the latest product of Phillips Products, Inc. (1435 E. 17th St., Cleveland, O.). Penapaint, says its maker, will remain visible through subsequent paint coatings or fabricating operations. Code markings cannot rub or wash off. When markings are no longer needed, Penapaint can be erased by using Penapaint Mask—a compound that Penapaint won't show through.

•

Temperature Pills: Tempil Corp. (132 West 22nd St., New York City) has just developed two pellets that indicate temperatures of 525 F and 650 F. Until now, pellets with these two temperature ratings were unavailable in Tempil's temperature-telling line. The Tempil pellet line covers a temperature range from 100 F to 2700 F.

•

Aluminum Etchings: Enthone, Inc. (New Haven, Conn.), subsidiary of American Smelting and Refining Co., is offering an improved formulation of Etchalume 14, its aluminum etching and cleaning compound. Etchalume 14, a powder, is used in water; it can be used over a wide range of concentrations and temperatures.

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Resin for Cement: Durez 19428, a heat-reactive phenolic resin for neoprene cements, is now available in commercial quantities from Durez Plastics Division of Hooker Chemical Corp. (North Tonawanda, N.Y.). According to Durez, addition of the new phenolic resin to neoprene cement results in better adhesion to Dacron, nylon, rayon, glass, metals and unplasticized plastic films. It is also said to minimize the tendency of bonded fabrics to deteriorate in sunlight. Durez 19428 is supplied in 325 drums. Cost: about 42¢/lb.

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Fungi Fighters: Metal & Thermit Corp. (New York) is now making bactericidal and fungicidal formulations for Permachem Corp. (West Palm Beach, Fla.). Products formulated by M&T for Permachem will contain tributyltin oxide and other organo-tin chemicals. Permachem's major marketing emphasis on its new products will be in the textile and public health fields. Other uses may come later.

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Paint Saver: Gallowhur Chemical Corp. (Ossining, N.Y.) has just developed an improved phenyl mercury fungicide for paints. The upgraded product, tradenamed Puratol-30, is said to be light in color (Gardner color rating below 1) and to work in oil, alkyd-, latex- and water-based paints. Gallowhur says that 0.5% of Puratol-30, based on total weight of paint, is enough to impart effective mildew and fungus resistance to the paint.

•

Flying Fuel Additive: A new corrosion inhibitor for aviation gasolines is now available from Du Pont's Petroleum Division. The product, to be marketed as Du Pont AFA-1 Aviation Fuel Additive, is said to be effective at low dosages. According to Du Pont, as little as 4 lbs./100 bbls. of gas prevents corrosion.

•

Cleaner Coater: Cowles Chemical Co. (Cleveland, O.) has just added another product to its line of Ty-Bond phosphatizing chemicals. Cowles says the new product, Ty-Bond R-1, not only cleans metal surfaces but also deposits an iron phosphate coating (up to 60 mg. sq. ft.) on ferrous metals, zinc and cadmium.

•

Antiseizer: Lehigh Chemical Co. (Chestertown, Md.) is now marketing X-1333, an antiseize compound compatible with liquid oxygen. The new material was developed for lubricating couplings, valves and other parts in liquid oxygen lines, in the missile and rocket field.

•

Zinc Rich Paint: The Bart Manufacturing Corp. (Belleville, N.J.) is introducing Galvafroid, a paint producing a dry film with 92-95% of metallic zinc. Bart says Galvafroid gives protection comparable to hot-dip galvanizing, can be applied over wet surfaces and is available in several formulations.

•

Long-Lasting Temporary: Helena Rubinstein will move its Color Lift, a temporary hair colorant, into national distribution March 1. Color Lift, claimed to last through five shampoos, is available in 10 shades. A 2-oz. bottle, enough for two applications, will retail for $1.50.

Purchasing Agent
H. L. Coulter, of
B. F. Goodrich Chemical Co.,
says:

"We think of all our suppliers as partners in progress, but . . ."

"They must think as we do of the importance of quality and service. They must pace their growth to match ours. Their sights must be set on the future. They must be sincere in their beliefs. They must deliver the goods on time and have the ability, experience, and facilities to back up their products with technical service whenever it is needed.

"In our opinion, these requirements are more vital today than ever before . . . Wyandotte meets them."

★ ★ ★ ★

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Market Newsletter

CHEMICAL WEEK
January 31, 1959

The phthalic anhydride war of nerves came to an abrupt end last week, when major producers slashed prices across-the-board by almost 20%. The explosive action, described by Monsanto as a "determined move to provide a more stable market by eliminating uncertainty surrounding recent phthalic anhydride pricing," had been nervously anticipated by the industry since last summer. The fuse was lit by Amoco Chemical's promise of lower phthalic prices when it comes onstream with its new plant in early '59 *(CW Market Newsletters, Aug. 23, Dec. 27, '58).*

Although many observers considered Amoco's potential output too small to greatly affect the total phthalic market picture, the firm undeniably reaped a bonus of considerable advance publicity.

The new price-cutting action by established producers, obviously timed to take the wind out of Amoco's sails, is not expected to last indefinitely. Reason: production costs—even Amoco's—will force prices back to higher levels. Right now, however, phthalic customers will get the material for 16½¢/lb. in tank cars, 17¢/lb. in carloads.

Rapid-fire, coast-to-coast repercussions in related chemical markets followed the phthalic price cut. On the West Coast, for example, Oronite Chemical promptly tacked an isophthalic acid price cut to the phthalic notification. A near-30% slash drops isophthalic, in carloads, from 22¢/lb. down to 15.2¢/lb. Officially, the cut was made to "accelerate development work on this important new product by Oronite customers," but it's clear that the move, at this time, is aimed at keeping isophthalic competitive with phthalic anhydride.

Tumbling phthalic prices have dragged down plasticizer prices, too. Monsanto is cutting tabs of 19 phthalate ester plasticizers by amounts ranging from 6-13%, depending on phthalic content. Dioctyl phthalate (DOP), for example, is reduced from 28¢/lb. to 25¢—the lowest price the material has ever carried. The move, incidentally, follows closely Monsanto's big 25% boost of phthalate ester plasticizer capacity (*CW Market Newsletter, Jan. 10*).

On the other side of the phthalic picture, the tab on crude naphthalene—basic raw material for phthalic manufacture—was reduced 2¢/lb., bringing tank-car costs to 5¢/lb.; that's close to the 4½-5¢/lb. range for imported naphthalene. Early this week, the price of refined (liquid) naphthalene followed, settled 2¢/lb. lower at 9¾¢/lb. in tank cars.

•

Elimination of U.S. maleic anhydride exports to Britain and other overseas countries may further strain the competitive U.S. maleic market (*CW, Jan. 17, p. 82*). Loss of these markets is expected in '61, by which time Monsanto Chemicals Ltd. is scheduled to complete construction of a 15-million-lbs./year plant at Newport, Monmouthshire. The plant

will reportedly be put up by Scientific Design (New York) and will utilize continuous catalytic vapor-phase oxidation of benzene.

Currently, the only other British source of maleic anhydride is Monsanto's existing plant at Newport; although capacity of the older unit isn't revealed, it's believed the new plant will more than treble Monsanto's total output. The expanded capacity not only will eliminate the need of British imports of maleic but also will provide a surplus for export.

•

The International Tin Council has tethered Russian tin exports to a 12-16,000-long-tons limit in '59, bringing to a head the long wrangle begun last year when Russia wreaked havoc by dumping the metal on world markets (*CW, Aug. 23, '58, p. 47*). This unofficial report from foreign sources is expected to be confirmed by the council this week. U.S. tin observers peg Russian tin exports at 13,500 long tons this year.

What did Russia get in return? Reportedly the freedom to sell this amount of tin anywhere in the world—which could mean only that Britain and other countries have dropped import restrictions on the metal. There's speculation, too, that Russia probably extracted other concessions but few guesses about what they might be.

One other worrisome problem plaguing world tin marketers is the existence of a huge tin surplus the council has accumulated as a buffer stock. It could be dumped on the market at any time, regardless of price conditions. For tin users, however, this is a happy situation because it eliminates all possibility of a sudden tin shortage.

•

The seventh price cut in seven years brings 2-vinylpyridine tabs down another 10¢/lb., effective Feb. 1. New prices posted by Reilly Tar & Chemical, made possible "by increased operating efficiency," are: $1.157/lb. in tank trucks, $1.20 in 10-drum lots, $1.35/lb. for nine drums or less. The last cut was made last summer (*CW Market Newsletter, Aug. 16, '58*).

•

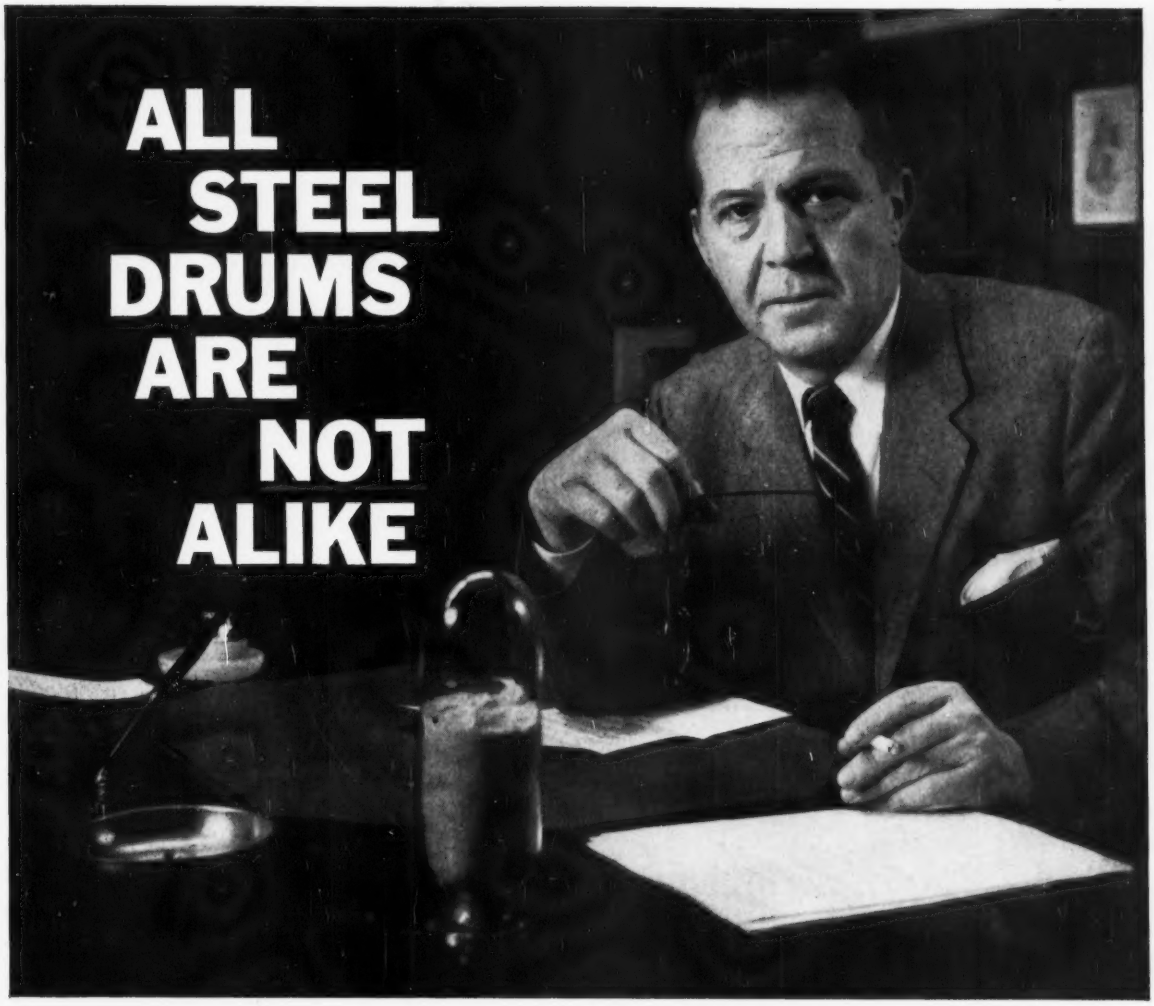
Dow Chemical this week revealed a new marketing plan for colored polystyrene (Styron). Feature: price advantages for purchases from high-unit-volume production. Customers can now order colored polystyrene for 1½¢/lb. differential (in truckload and carload quantities) over the base prices for crystal and natural materials.

SELECTED PRICE CHANGES — WEEK ENDING JANUARY 26, 1959

	Change	New Price
UP		
Ammonium nitrate, dolomite, bgs, c.l.	$1.00	$45.50
Coconut oil, crude, tanks, Pac. Coast	0.005	0.185
Sodium nitrate, dom., crude, bgs.	1.00	45.50
DOWN		
Di-iso-octyl phthalate, dms., c.l.	0.03	0.275
Dibutyl phthalate, dms., c.l.	0.04	0.285
Litharge, coml., powd., bbls., c.l.	0.01	0.1375
Naphthalene, crude, dom., tanks	0.02	0.0425

All prices per pound unless quantity is stated.

ALL STEEL DRUMS ARE NOT ALIKE



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2. Punctual deliveries. Seven convenient plants assure you of a smooth, even flow of containers. Your normal needs are filled without stops and starts, *and* you get quicker delivery on rush orders.

Maximum protection, simplified purchasing, punctual deliveries: you get all these extras at no extra cost. Why not talk over your needs with the man from U. S. Steel?

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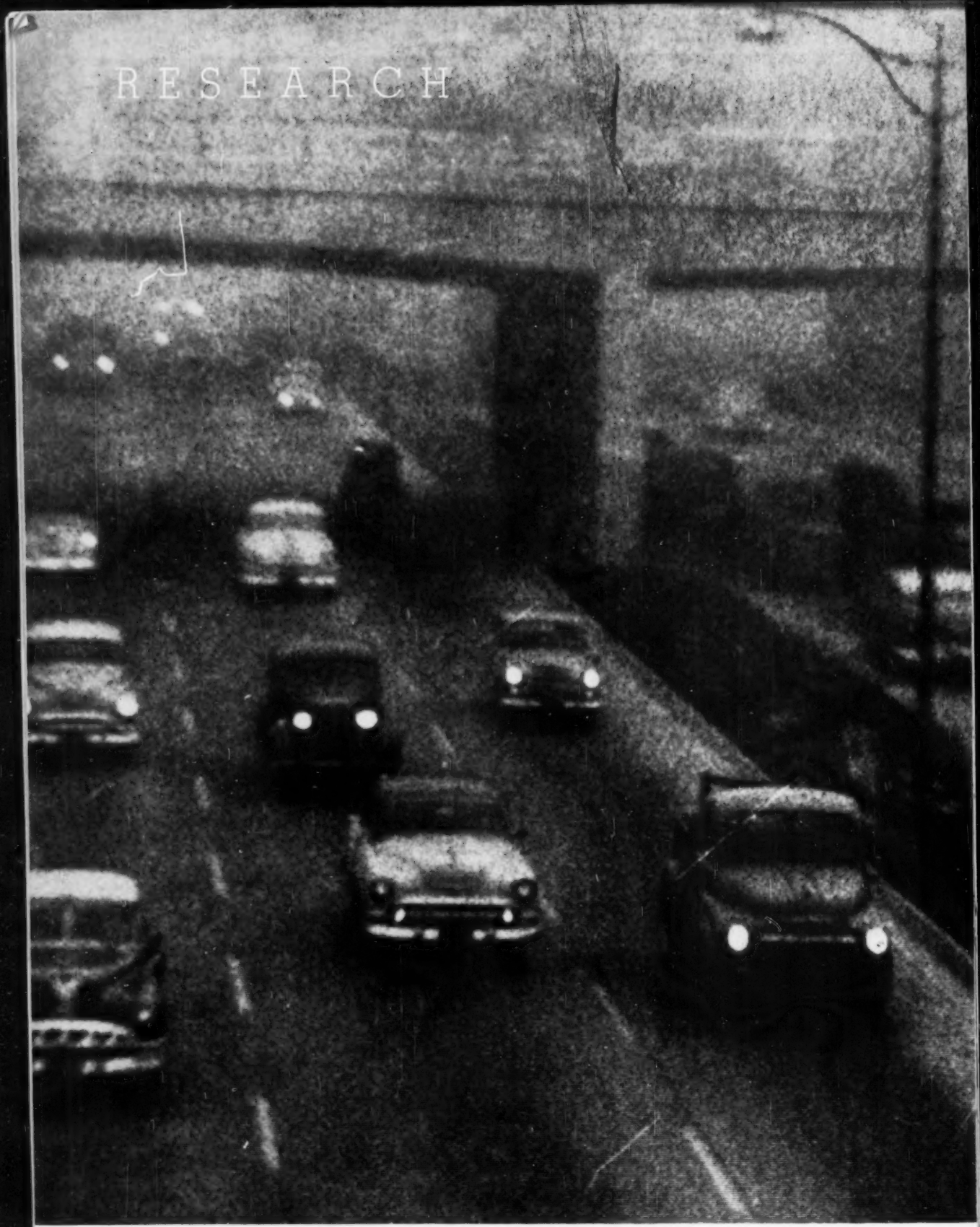


LOS ANGELES ROAD-BLOCKER: Traffic-slowing haze is being attacked by research on devices that rem smog-causing fuel hydrocarbons from automobile engine exhaust fun

Catalysts Pierce Smog Blackout

This week, long-suffering smog victims are cheering three new experimental auto exhaust purifiers unveiled at the recent Detroit meeting of the Society of Automotive Engineers. Each converts unburned fuel hydrocarbons into harmless carbon dioxide and water, greatly reducing the output of the hydrocarbons which are suspected of reacting with nitrogen oxides in the atmosphere to produce smog irritants.

Behind two of the devices is extensive catalyst research—which may bloom into CPI profits if the purifiers prove practical and are eventually mass produced. The third unit is an afterburner, rather than a catalytic converter; it uses only oxygen and heat.

The catalytic converters stem from research by Ford and General Motors, the latter in cooperation with Oxy-Catalyst, Inc. (Wayne, Pa.). The afterburner was developed by Ramo-Wooldridge, a division of Thompson Ramo Wooldridge Inc. (Los Angeles).

Pentoxide Play: At the SAE meeting, James Chandler and R. T. Van Derveer, of Ford's Engineering Research Office, displayed the Ford converter, which uses a vanadium pentoxide catalyst to eliminate 60-73% of the exhaust hydrocarbons, depending on driving conditions. William Cannon and Charles Welling, of the Ford Scientific Laboratory, reporting on the catalyst, called it the most promising of more than 100 catalytic agents involved in Ford's research, which was part of a cooperative study undertaken by the Vehicle Combustion Products Committee of the Automobile Manufacturers Assn.

That's good news for a bevy of CPI sources of vanadium pentoxide.

A truly staggering quantity of the oxide would eventually be required if the converters were mass-produced. Ford reveals that its converter (which is similar in appearance to a standard auto muffler) holds 25-30 lbs. of pellets (balls or cylinders), which have a 10% (by weight) vanadium pentoxide coating on an alumina support. Ford is paying $1.28 to $1.33/lb. for technical-grade vanadium pentoxide in experimental quantities. Should the special muffler go into production, Ford believes this price would drop below $1/lb., perhaps to around 70¢/lb. High-purity oxide is not required, the firm reveals, although the amount of contaminant that is allowable has not yet been determined.

There are still many other research problems to be solved to make the converter practicable, Ford warns. Ford would like to extend the catalyst life, estimated at 10-12,000 miles, to a useful life of 15-20,000 miles. In addition, it will be necessary to determine if there is a need for a high-temperature bypass for periods of extended heavy-duty operation to prevent excessive catalyst temperatures. Unpleasant exhaust odors that occasionally arise must also be eliminated.

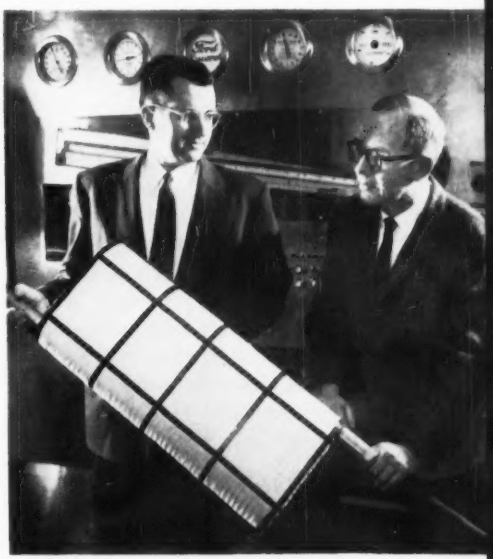
GM Deal: General Motors is said to have already signed an agreement with Oxy-Catalyst, to use the latter's catalyst, which GM has evaluated. Although chemical details of the catalyst have not been revealed, it reportedly performs better than vanadium pentoxide in autos burning leaded gasoline. G. J. Nebel and R. W. Bishop, of GM Research Laboratories, evaluated the catalyst and estimate its useful operational life at 12,000 miles.

Their report calls catalytic oxidation of automobile exhaust gases "technically feasible even when using commercial leaded gasoline." With a combination of the catalyst to remove hydrocarbons and carbon monoxide and the special carburetor to remove oxides of nitrogen, they state, "the following reductions (after warm-up) seem reasonable; hydrocarbons, 90%; carbon monoxide, 75%; oxides of nitrogen, 90%."

However, they add, "Many difficult problems must be solved before catalytic oxidation will become commercially acceptable. The solution of these problems will require a major engineering development program."

Some of these needs, such as quieter muffler operation, may have been solved by Ramo Wooldridge, which says its afterburner is "capable of removing at least 90% of the hydrocarbons in automobile exhaust," and that "it acts as an efficient silencer, therefore replaces the conventional muffler." However, the firm admits to practical difficulties at high temperatures so that the size of its device is "a compromise between desire for compactness and limitations imposed by suitable materials of construction." Item: The Norris-Thermador Corp. (Los Angeles) has also been attempting to develop a suitable exhaust purifier, and is reported to have discarded the afterburner concept in favor of catalytic conversion.

Just in Time: Meanwhile smog-stricken Los Angeles is impatiently awaiting a practical device that will cut pollutants spewn by its 3 million autos. The city's lawmakers have already introduced in the city council measures that would require all new autos in the city to have "approved" antismog devices—even though such



Ford's Chandler, Van Derveer and vanadium oxide catalytic converter.

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devices are not yet being manufactured for automobiles.

Many of the California legislators who have included smog-control laws in their political platforms realize, of course, that the immediate enforcement of such a law isn't yet technically feasible. But they seek to force the adoption of antismog devices as soon as they are available.

City councilmen are attempting to decide on a realistic target date—sometime in '61 or '62—after which cars sold in Los Angeles would be required to have the approved device. One version provides a 7% penalty on the sale price; another forbids the sale outright.

Cost may not be a roadblock to installation of exhaust purifiers. Los Angeles Air Pollution Control District Director Smith Griswold tells *CW*: "It may well be that we'll have a practical $50 muffler (purifier) before we have the installation and inspection program worked out to put the device to use." Realistic estimates of installation price start below $50 and go as high as $150. Ford figures the cost of its converter will be around $150 installed, possibly less in mass production. But the Oxy-Catalyst converter will cost less than $50, says Griswold, and he calls it "a major cost breakthrough." He points out, however, that it remains to be seen whether it can be fitted to cars now on the road.

There's one big consideration remaining: the device that is legally required must work, for the total investment will be big, and auto owners wouldn't relish having to buy a second device. Meanwhile, the number of cars grows daily, and until an approved auto exhaust purifier is developed and applied it seems likely that there will be no appreciable reduction in smog.

EXPANSION

• Harris Research Laboratories Inc. has moved to new, larger quarters at 6220 Kansas Ave. N.E., Washington, D.C.

• Du Pont's Electrochemicals Dept. (Niagara Falls, N.Y.) has dedicated a new, two-story research center.

• American Cyanamid Co. (New York) has established a high-polymer section at its Stamford, Conn., laboratories. A broad program of studies, including new monomers, organic and inorganic polymer synthesis, new catalyst systems, polymer architectural control and mechanism studies, will be emphasized.

• Crown Zellerbach Corp. (San Francisco) has started construction of a $110,000 pilot-plant building for use in its Chemical Products Division (Camas, Wash.). The plant will be used to develop uses for lignin, wood sugars and other by-products of paper manufacturing.

• Georgia Institute of Technology (Atlanta, Ga.) has dedicated its new, $500,000 nuclear laboratory.

PRODUCTS

New Polyol: Arnold, Hoffman & Co. (Providence, R.I.) is out with a new polyol, N,N,N′,N′ tetrakis (2-hydroxyethyl) ethylenediamine. Suggested uses: as a chelating agent, humectant, crosslinking agent, plasticizer.

•

Imported Enzyme: Nagarse, a pure crystalline lyophilized proteolytic enzyme by Nagase and Co. Ltd. (Osaka, Japan), is available from Biddle Sawyer Corp. (New York). It is reportedly useful for treatment of cataract and sinusitis.

•

New Synthetic Rubber: Goodyear Tire & Rubber Co. (Akron, O.) is out with two new general-purpose synthetic rubbers, which are extended with 50 parts oil (generally, rubber may be extended with up to 37½ parts oil). The new products, called Plioflex 1713 and 1714 C, respectively, offer nondiscoloring, nonstaining and light-color characteristics.

•

Monomer: A new experimental monomer called X-970 is the latest entry of Rohm & Haas Co. (Philadelphia). It's a high-boiling, low-viscosity ester that may be polymerized by heat or catalysis to a cross-linked thermosetting polymer. It's said to be suitable as a modifier for polyvinyl chloride plastisols.

•

Tissue-Building Hormone: E. R. Squibb & Sons' (New York) latest entry is Dumogran, an oral tissue-building hormone, containing methyltestosterone and ethinyl estradiol. It's said to restore muscle tone, promote emotional balance, mental alertness in middle-age and older patients.

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Princeton Area Science Education Committee* offers scientific talent to New Jersey board of education.

Scientists Plan New Help for Teachers

In an obvious turnabout, a group of industrialists in Princeton, N. J., are this week counseling the educators. The counsellors: the Princeton Area Science Education Committee. Their job: assisting the state board of education in setting up a network of area science education groups through the board's Cooperation Between School and Industry Science Programs Committee.

The readiness with which the community has taken to the Princeton group points up the needs of some science teaching programs and the enthusiasm of most communities in trying to supplement them.

So vital has been the demand for help that, in one year, the committee has built a program as complete and varied as those achieved in several years by similar groups in Richmond, Calif., Stamford, Conn., Shreveport, La., Trenton, N.J., and a few other cities.

The Princeton group's setup offers a helpful guide on how to organize such committees, how to speed their effectiveness. The committee, composed of representatives from a score of industries located in the area, including many chemical process plants, works closely with local educators. Three major aims: interest youngsters in science, bolster already-existing teaching, and develop techniques of putting these objectives across.

Mainstay: One of the most effective tools of the committee is a speakers bureau. More than 65 employees of local industries have been recruited to make talks on such diverse subjects as astronomy, atomic energy, biology, chemistry, communications, mathematics, petroleum and physics. Also they speak on such general topics as evaluating new drugs, relationship of engineering costs to product pricing, and careers in service jobs in industry.

Already in this school year, 25 talks have been made and a heavy schedule is shaping up for the remainder of the year. Talks have been made before civic clubs as well as in schools.

Energizers: Sparking the committee's activities have been its founders, Cyanamid Process Control Dept. Manager Max Blumenfeld and Food Machinery and Chemical's John Alden, supervisor of technical informa-

*Left to right: John Fenn, Princeton University; Richard Borup, Cities Service Research & Development Co.; Max Blumenfeld, American Cyanamid Co.; Robert Schwenker, Jr., Textile Research Institute; John Alden, Food Machinery and Chemical Corp.

tion services. Two years ago, the two men got together to discuss possible activities for Chemical Progress Week, sponsored by the Manufacturing Chemists' Assn. They devised a speakers program. It's that program that last year developed into the science committee and has since grown to embrace many more activities. Current projects:

- Plant tours have been arranged by participating companies so that students and visitors can see different industries and learn of the mechanical complexes peculiar to each.
- Teacher seminars are being held to allow high school teachers to hear lectures by local industry people concerning their industrial specialties.
- Curricula advisory programs permit industry people to advise educators—but only when asked—on keeping high school and grade school science curricula up to date.
- Equipment exchange keeps the school system informed of what surplus equipment and materials are on hand at the industrial locations. This equipment is available for school laboratory use.
- Summer observation jobs are arranged for by the committee to permit high school youngsters who have made good showings in the classroom to spend time working and observing in the industry of their choice.
- Career guidance for students. Industry people work individually with students interested in finding out more about specific careers.

Wide Activity: The committee operates in an area within a 10-mile radius of Princeton, in such communities as Jamesburg, Hightstown, Lawrenceville, Cranbury, Plainsboro.

The committee feels that its member firms can offer "a rich and varied pool of scientific talent not normally available to the schools that can supplement and enhance science and mathematics" teaching.

Organization is informal. As Blumenfeld puts it, "We have no constitution and no funds. All we try to do is represent practicing scientists in the area." Success has been due largely to personal contact; the scientists have gone to their companies and to school people they know and made arrangements for talks and activities mutually acceptable. Companies have a free hand in accepting or rejecting projects on their individual merits. If a company feels it cannot participate in plant tours or that its policies don't permit the hiring of summer students, it is free to reject that portion of the scheme. Consequently, most industries in the area have been able to participate in one way or another to fill out the varied program.

Though the organization is informal, the committee has published a booklet containing the names of its members and names of people to contact. It lists all the talks that are available to teachers and the plant tours that can be made. The booklet also states the principles of the committee. It is distributed throughout the school system.

As to the future, the Princeton Scientific Committee feels that it still has a wealth of project ideas. The response so far by local educators clearly indicates that the group's new programs will be sure of a warm reception in the community.

Classroom talks by industry men are mainstay of program.

Oil-Strike Fear Fades

The much-discussed threat of an oil industry strike last week seemed to be dissolving.

The Oil, Chemical & Atomic Workers Union demand for a 25¢/hour wage increase was met with a 5% increase offer by Sinclair Oil Co., which has a "master" contract with OCAW. The offer is roughly 13½¢/hour—half the union's demand.

Last week, union policy chiefs accepted the bid, subject to membership ratification. This helped allay fears of many petrochemical users and producers, and may be a guidepost for upcoming negotiations between OCAW and chemical producers.

Sinclair, the only oil company that has a master contract with OCAW (one contract covers all employees at all plants), has been a major element in the union's plans. If Sinclair chose to risk a strike, OCAW could assume other companies would risk strikes, too. Thus, an OCAW-Sinclair settlement could well set the oil industry's wage pace. Now that Sinclair's offer seems acceptable to OCAW, most observers expect similar offers to be made by the nation's oil companies.

And with good reason. Near week's end, it looked as though a wave of 5% offers was sweeping the industry. How many of the 95,000 workers who had voted strike authorizations were among those accepting the proposals was not known at press time.

Among the 5% offers: Gulf Oil to its OCAW local at Port Arthur; Indiana Standard to Central States Petroleum Union locals and Independent Petroleum Workers of America at plants in Whiting, Ind., Wood River, Ill., and Milwaukee; and Socony Mobil at East Chicago. On the Eastern seaboard, some independents have accepted an Esso Standard proposal of 5%.

Strike Votes: In spite of the Sinclair progress, strike authorization balloting in three Los Angeles Basin locals was still in progress last week. But, OCAW District No. 1 council members had received an offer from Standard of California and Continental Oil patterned after the Sinclair bid. OCAW District No. 1 includes California, Washington, Oregon, Arizona and Nevada.

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Property Data	
Molecular Weight	64.06
Specific Gravity	
Liquid.....Water=1@0°C (32°F)	1.434
Gas.....Air=1@0°C & 760 mm	2.2636
Melting Point..(−103.9°F)	−75.5°C
Boiling Point..(14°F)	−10.0°C
Refractive Index	
Liquid...(I.C.T. 1, 107)...n20°/D (68°F)	1.410
Gas (Mellor, J.W. Vol. X, 197) n15°/D (59°F)	1.000686

ANSUL CHEMICAL COMPANY • MARINETTE, WISCONSIN

LEGAL

Soapers Win Cutoff Date: A federal court ruling last week gave the "Big Three" soapmakers a pretrial victory in the six-year-old civil suit charging them with violations of the Sherman Antitrust Act.

The ruling: 1946 is fixed as the cutoff on acts to be considered evidence against the companies. Alleged violations by the firms prior to then will not be considered during the trial, which will probably be heard in the fall.

The soap companies — Procter & Gamble, Lever Brothers and Colgate — fought for the '46 cutoff date because, they claimed, their prewar activities had already been the subject of a government suit. (In '41, the government charged they violated the antitrust act. The companies did not contest the suit, which was subsequently dropped.)

Government attorneys had claimed the right to enter into evidence all the information they have on the companies' activities.

U.S. district court Judge Richard Hartshorne (Newark, N.J.) said he set the '46 cutoff date in an effort to keep the trial from becoming unwieldy. If the government loses this case, it can sue again, focusing on the prewar years.

•

Sales Tax Refund: Westvaco Chlor-Alkali Division of Food Machinery and Chemical Corp., has been awarded a $9,173 refund on West Virginia gross sales tax assessment. The tax had been paid by Westvaco in connection with work performed on a government contract.

Kanawha circuit court Judge Frank Taylor awarded the partial tax refund because part of the work done under the contract was performed in New York. Westvaco (Charleston, W. Va.) paid gross sales tax of about $15,000 on more than $1 million earned for services performed as subcontractor of Universal Oil Products Co. The work involved research and testing of unnamed chemicals (reportedly for missile fuel research).

Westvaco objected to the tax on the grounds that it lost money on the project, was acting as an agent for the U.S., was performing "professional services."

The court ruled out those points, but agreed that $134,190 received by Westvaco for the research work in New York was not taxable under the state's gross sales tax law. Administrative and materials costs, the court ruled, could not be similarly apportioned, because the company failed to present a breakdown of those items.

KEY CHANGES

David R. Bagenstose to director, Thomasson of Pa., Inc. (Norristown, Pa.), aerosol products manufacturer.

Bruce D. Gleissner to vice-president and technical director, Frontier Chemical Co., division of Vulcan Materials Co. (Wichita, Kan.).

Thomas Dabovich to vice-president, Morton Chemical Co. (Chicago).

John F. Allen to president and chief executive officer, New Process Chemical Co. (San Francisco).

Garth W. Edwards to treasurer, **Louis A. Carapella** to vice-president, Sylvania-Corning Nuclear Corp. (Bayside, L.I., N.Y.).

Albert R. Wayne to vice-president, operations, Mead Johnson International; **Robert H. Kinderman** to vice-president, finance; Mead Johnson & Co. (Evansville, Ind.).

W. William Theis to vice-president in charge of sales, A. S. Harrison Co. (South Norwalk, Conn.).

KUDOS

To **Aaron Wachter,** director of research, Shell Development Corp. (Emeryville, Calif.), the 1958 Frank Newman Speller Award of the National Assn. of Corrosion Engineers.

DIED

Sylvan H. Kline, 65, secretary, director, regional manager, W.P. Fuller Paint Co. (San Francisco).

John M. Taylor, Sr., 67, founder, past board chairman, Taylor Fibre Co. (Norristown, Pa.), at Villanova, Pa.

Jerome Alexander, 82, consultant chemist and chemical engineer, colloid chemistry specialist, at New York.

CW PHOTO—CHARLES TINNEY

Du Pont's Greenewalt: 'The organization is nothing but a slice of life.'

Uncommon Award

Crawford Greenewalt, president of the Du Pont Co., last week received the annual Poor Richard Club Award given to "an outstanding public figure" by the Philadelphia club. The award stemmed from his defense of the "Uncommon Man" in his just-published book by that name.

Purpose of the book is to show that business—as exemplified by Du Pont—cannot be successful without uncommon men who have bold ideas and the courage to carry them out.

For management readers seeking fresh ideas for combating the problem of conformity and personality submission in business, Greenewalt makes these observations:

- On executives: "It would be as hard to crystallize a 'typical' example . . . as it would be to find a . . . representative sports editor . . . or geologist. And just as pointless."
- On business: "I cannot see that there is anything to make commercial institutions less worthy or less desirable . . . of their participants than other institutions or . . . professions."
- On uncommon men: "And perhaps most uncommon of all is the common man whose achievements are exalted beyond the expectation of his circumstances. The important thing is that we bring into play the full potential of all men. . . ."
- On organization: "Hence, the organization is nothing more than a slice of life. Whatever individual dispositions may be present, it is the composite which must prevail."

New Concept in Bulk Material Containers
Eliminates Spillage of Free-Flowing Granular Products

CYLINDA-PAK

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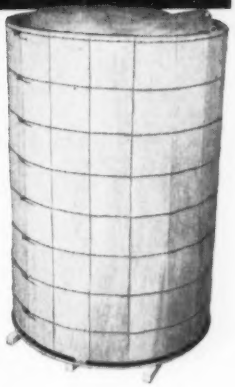
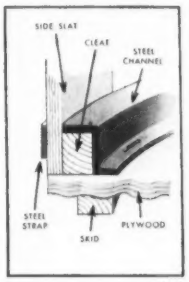


Cylinda-Pak Generalift wirebound pallet boxes bring a new concept in containers for bulk handling. Strong and resilient design prevents puncture or breakage that causes spillage and allows extra high stacking without bulging. They are light in weight and have an exceptional ratio of tare weight to contents. They ship and store flat and can be assembled by unski ed labor in 4 man minutes.

Cylinda-Paks have sides of tough hardwood, bound by galvanized steel wires. The base of rigid plywood is mounted on hardwood skids and equipped with a special steel channel, shown at the right. Inside cleats at the bottom of the vertical side sections are held in the channel by a tensioned steel strap. This construction has been thoroughly tested in the laboratory and proved in use.

Cylinda-Pak Generalifts are available in "one-trip" and "reusable" design and in a variety of sizes for both truck and rail shipments. Write for details.



General Box

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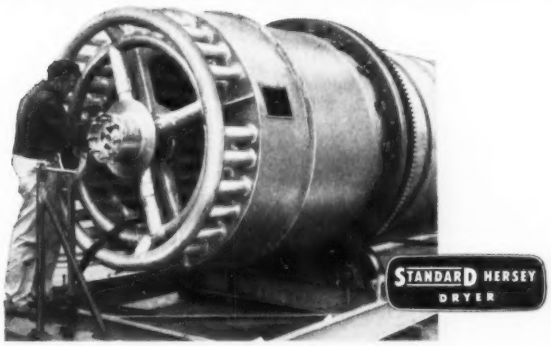

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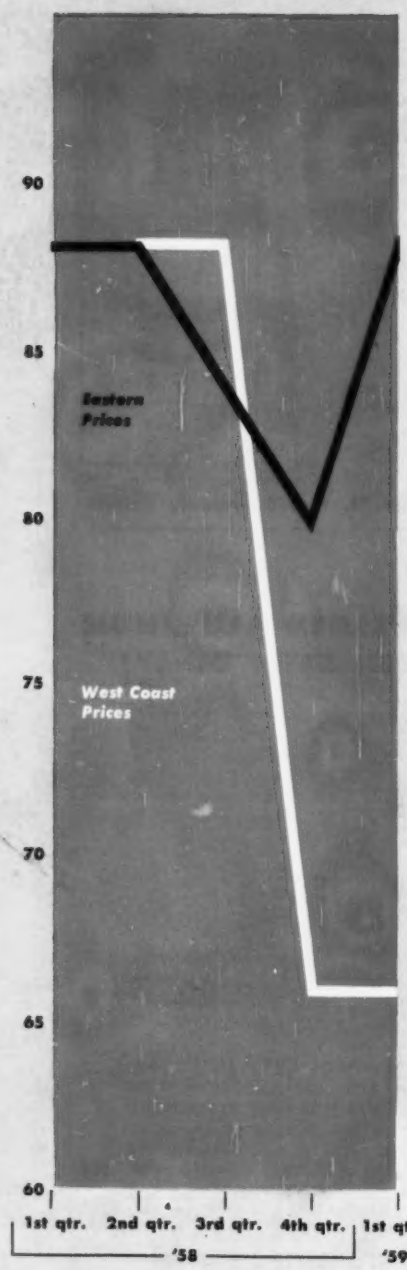

··· reflects booming western ammonia capacity

	Existing capacity (tons/year)	Planned expansions (tons/year)
CALIFORNIA		
Collier Carbon & Chemical Brea, Calif.	86,000	15,000 under way
Dow Chemical Pittsburg, Calif.	9,000	———
Hercules Powder Pinole, Calif.	50,000	———
Shell Chemical Ventura, Calif. Pittsburg, Calif.	75,000 115,000	——— ———
Standard Oil of Calif. Richmond, Calif.	110,000	12,000 under way
Best Fertilizer Lathrop, Calif.	———	45,000 due Feb. '59
Valley Nitrogen Producers Fresno, Calif.	———	60,000 under way
WASHINGTON		
Phillips Pacific Chemical Finley, Wash.	86,000	———
Hooker Chemical Tacoma, Wash.	22,000	———
OREGON		
Pennsalt Chemicals Portland, Ore.	7,000	———
UTAH		
U.S. Steel Geneva, Utah	70,000	———
ARIZONA		
Apache Powder Benson, Ariz.	11,000	———
Southwestern Agrochemical Chandler, Ariz.	———	22,000 under way
Totals	641,000	154,000

What Next for Ammonia?

The plummeting price of ammonia on the West Coast (*chart, left*) has thrown the whole market into an uproar. By old standards, the start of a new fertilizer season (as is the case this month) should have eliminated the last of the old year's seasonal discounts. But it hasn't — and the question this week is whether the confusion on the West Coast will extend to the Midwest and East.

The extremes in the regional differences in ammonia prices show plainly in last week's quotes, turned up in *CW's* country-wide check:

- California, environs, $66/ton.
- Pacific Northwest, $85/ton.
- Utah and nearby, $80/ton.
- East of the Rockies, $88/ton.

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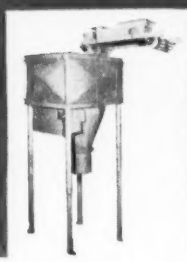

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the explosive Western price situation — and to the current national uncertainty — was Best Fertilizer's action a few months ago. Best, a semicooperative in California, offered ammonia at $63/ton for '59 off-season delivery and $68/ton for delivery during the '60 season. Shipments were to be made from its new plant at Lathrop, Calif. (*CW Market Newsletter, Sept. 20, '58*). *CW* learns that Best's new installation will start full operation some time next week.

Best's quotes were made not only to co-op members but also to nonsubscribers. The obvious bid for nonmembers triggered a violent reaction in the market. Most purchasing agents held up renewing contracts with other suppliers until they could determine if the move meant an industry-wide price cut.

Shell, largest producer on the West Coast, immediately chopped its tags to $66/ton — not quite down to the off-season co-op level, but $2 under Best's '60 in-season price. The company said frankly, "We cut our ammonia price to avoid further loss of current and prospective business."

Shell's drastic move literally forced other producers to follow suit, since all were plagued with excessive supplies. One unhappy producer said: "The current ammonia pricing situation in California is unrealistic. And because of the rough competition we can't foresee any improvement."

Chances of restoring prices to near previous levels seem remote, despite reports that Shell might reverse its position. L. M. Roberts, general manager of Shell Chemical's Ammonia Division, spelled out the probable trend to *CW*'s West Coast reporter: "It's almost inconceivable," he said, "that the price of ammonia in the West will go up in the near future. But if prices do go up, it will be because they are forced up by the continually increasing costs of natural gas, electric power and labor."

Where Does It Go? To evaluate the West Coast ammonia market and its upset, take a close look at the total nitrogen situation. About 88-90% of ammonia output in that area goes into agricultural uses, either through direct application, or as a raw material in the production of other nitrogenous fertilizers (ammonium nitrate, urea, etc.).

Current supply of West Coast nitrogen runs about 672,000 tons/year. With the injection of an additional 154,000 tons of ammonia supply from new plants and expansions (under construction or planned), nitrogen output potential will swell to a massive 826,000 tons by the end of the year. But requirements for '59 will run about 500,000 tons, only 60% of potential production. An indication of the seriousness of this problem: even if nitrogen requirements continue to grow at the rate of 5-9%/year, it would still take at least five years for supply-demand to come into good alignment. And this assumes no additional expansions will be carried out in the interim.

One gloomy implication of the present overcapacity-low price picture: private capital will steer clear of new ammonia ventures in the West. The present low return on the $66 price means a long payout period—unattractive to most investors. Even if the price were kicked back up to $85 or $88, the huge overcapacity problem would dampen any potential producer's enthusiasm for risking money in a plant that might operate at 30-40% of capacity. This doesn't, however, rule out the possibility of co-ops' building new plants, although low ammonia prices reduce incentive. Right now, three of the new plants under construction are those of co-ops.

Largest new installation is Best's 45,000-tons/year plant at Lathrop. Later this year, Valley Nitrogen Producers will be able to produce 60,000 tons at Fresno, Calif., and Southwestern Agrochemical about 22,000 tons at Chandler, Ariz. Noncooperatives Standard Oil of California and Collier Carbon & Chemical will add 12,000 and 15,000 tons/year to output.

California Impact: Adjacent markets have also felt the impact of California's bargain-basement prices. Even with freight charges added, ammonia can be shipped into these areas at prices lower than those of locally produced material. Result: local producers cut prices to remain competitive.

In the Pacific Northwest, prices have dropped only twice since World War II: once (in '57), when Phillips Pacific Chemical started producing at a new plant, tags dropped $6.50/ton, to $90. Last year, schedules were reduced to $85/ton.

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MARKETS

The threat of underselling has also crept into Utah markets, prompting U. S. Steel to drop prices to $80/ton, $8 under previous lists.

A moot point that invariably arises when fertilizer prices go down is whether the reductions will increase farmers' usage. Actually, under the lower California Ammonia schedules, consumers could obtain 4 tons at about the same price they previously paid for 3 tons. But farmers, who usually postpone purchases until needed, will instead probably pocket any current savings, hope that fertilizer prices will drop even more when they're ready to work the land. But their figuring may go awry. Consensus of sellers is that the in-season price of $66/ton is close to rock-bottom.

The big question for producers still further East: Will California price reductions set off a chain reaction throughout the rest of the country? Consensus of many ammonia makers interviewed by *CW*: the West Coast situation is a local issue, due chiefly to overcapacity and panic price-cutting. Chances are that no further price cuts will be made to buyers east of the Rockies, since substantial amounts of ammonia — mainly for fertilizer use — are still moving at posted prices. Producers thus lack pressure to cut tags at this time.

Nonetheless, trade talk is that ammonia prices for industrial use elsewhere than the Coast are not firm and that many producers are offering lower-than-posted figures. About 20-25% of ammonia sales in the East go into nonagricultural outlets. When faced with a competitor who is offering industrial ammonia for less than $88/ton, a producer generally counters with a lower price to gain the business. In some cases, it is reported, the seller asks a customer how much a competitor is quoting; and if price is the main consideration in closing the sale, a lower figure will be negotiated. *CW* has not been able to get confirmation or denial of these reports.

The industrial ammonia pricing structure, of course, influences the structure of the agricultural product. But ammonia sellers have resisted major price cuts for years — since excess ammonia capacity was added during the Korean War — and most seem prepared to continue to hold to their current prices.

Polystyrene Cover

Polystyrene is now making a bid for another part of the big house-construction market—this time as a lightweight, easy-to-install and competitively priced roof insulating material. Introduced to the trade by Dow Chemical, at the National Assn. of Home Builders show, polystyrene Roofmate broadens the plastic's insulating applications to literally cover a house from top to bottom.

Introduction of the insulator—for use under built-up roofs—is keyed to Dow's program to adapt expanded polystyrene to varied insulating uses. It follows the marketing of Scorboard—two years ago—which is a polystyrene designed for insulating foundation perimeters and cavity walls. And Dow's market timing for Roofmate could hardly be better in light of the expected '59 pickup of general construction that will boost private housing starts 3% and public construction 14%.

The market Dow is trying to crack with polystyrene is a big one. One trade estimate puts the potential roof insulation demand as high as 700 million board ft./year. This, however, includes insulation on roofs of all structures throughout the country, of which foamed plastics could qualify for 400-500 million sq. ft.

Polystyrene roof insulation will be priced "in accordance with prevailing industry schedules," according to Dow. (In other insulating applications, polystyrene has been priced at 10¢/-bd. ft., compared with 8¢ for phenol formaldehyde and 16¢ for urethane.)

Slow To Take Hold: Although expanded plastics have sold well in refrigerator insulation markets, they have not done so well in penetrating residential construction markets. Cost has been a big factor—most home insulation is usually low-cost mineral fill, batts and blankets. Moreover, building codes in many areas limit use of foamed plastics for this sort of construction; and only a few codes allow sandwich construction with plastic cores. The size of this market is an estimated 1.8 billion bd. ft./year, of which cellular plastic materials can at best garner only a small part in the foreseeable future. But in roof insulating, where building codes are not likely to be as strict, polystyrene seems to have a good chance.

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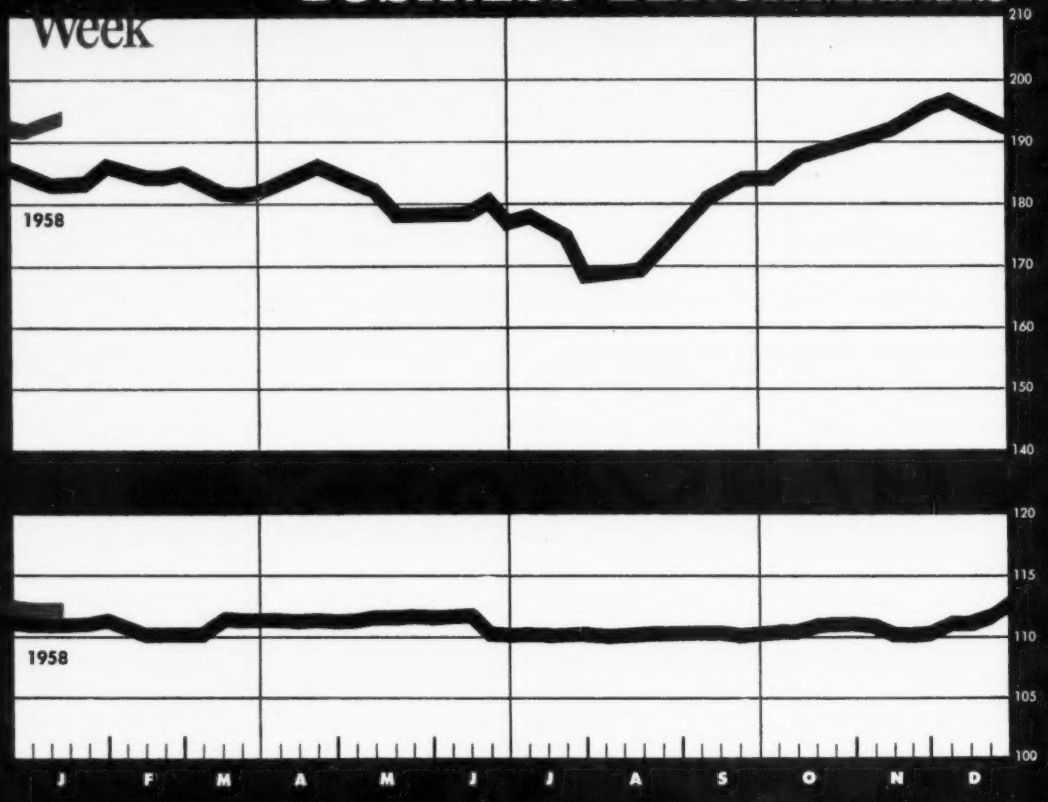


JANUARY 31, 1959

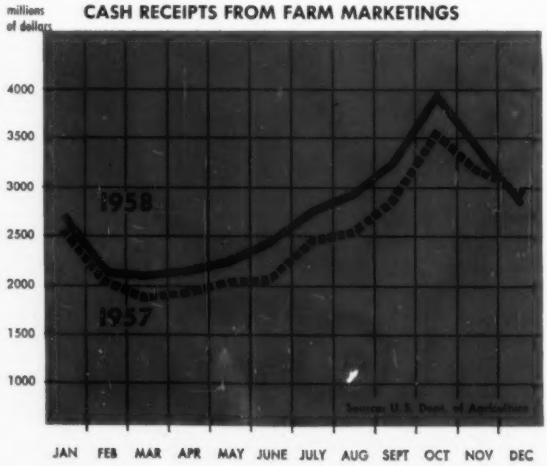
WEEKLY BUSINESS INDICATORS	Latest Week	Preceding Week	Year Ago
Chemical Week output index (1947-49=100)	193.0	194.0	185.0
Chemical Week wholesale price index (1947=100)	110.5	111.9	111.1
Stock price index (11 firms, Standard & Poor's)	50.12	49.40	40.39
Steel ingot (thousand tons)	2,147	2,111	1,496
Crude oil and condensate (daily av., thousand bbls.)	7,087	7,052	6,925

MONTHLY INDICATORS—Trade

	Manufacturers' Sales			Manufacturers' Inventories		
	Latest Month	Preceding Month	Year Ago	Latest Month	Preceding Month	Year Ago
All manufacturing	27,627	27,158	27,221	49,339	49,337	53,871
Chemicals and allied products	2,043	2,077	1,941	3,766	3,760	3,763
Petroleum and coal products	2,863	2,903	2,717	3,318	3,276	3,657
Paper and allied products	934	947	862	1,418	1,423	1,417
Textile products	1,089	1,042	1,025	2,456	2,490	2,628

FACTORY SHIPMENTS OF MAJOR APPLIANCES

CASH RECEIPTS FROM FARM MARKETINGS



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A pinch of Cab-o-sil, the unique Cabot "airborne" silica — puts a far deadlier punch in insecticides by literally dehydrating insects to death. Superfine particles of Cab-o-sil absorb the waxy protective coating of the insect's body, rob it of the body moisture it needs to survive. Insects can't build up immunity because the action of free-flowing Cab-o-sil is physical. And there's not a worry in the world about children or pets — Cab-o-sil is non-toxic, and F.D.A. approved for use in insecticides.

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- **Reinforcing agent** — rubber, silicone, latex film
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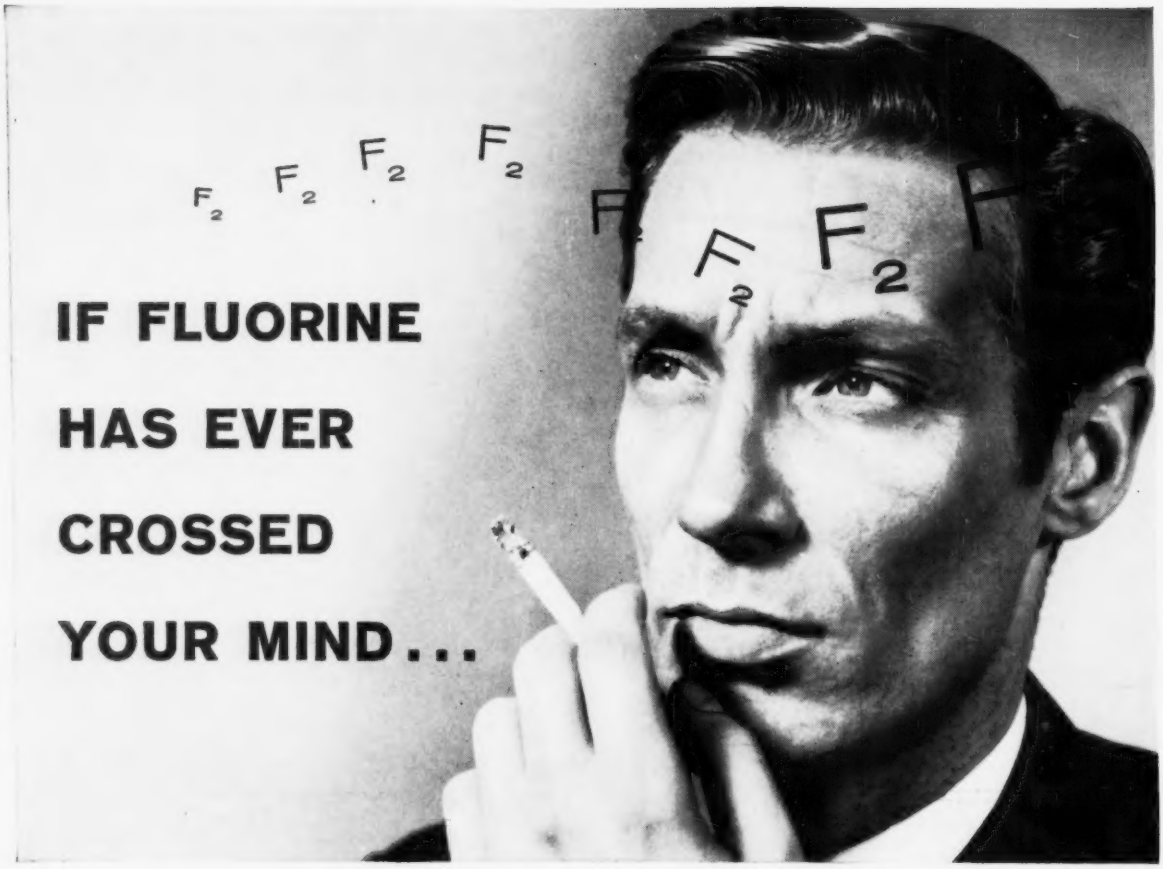

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